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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **4499**

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Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion. **4548**

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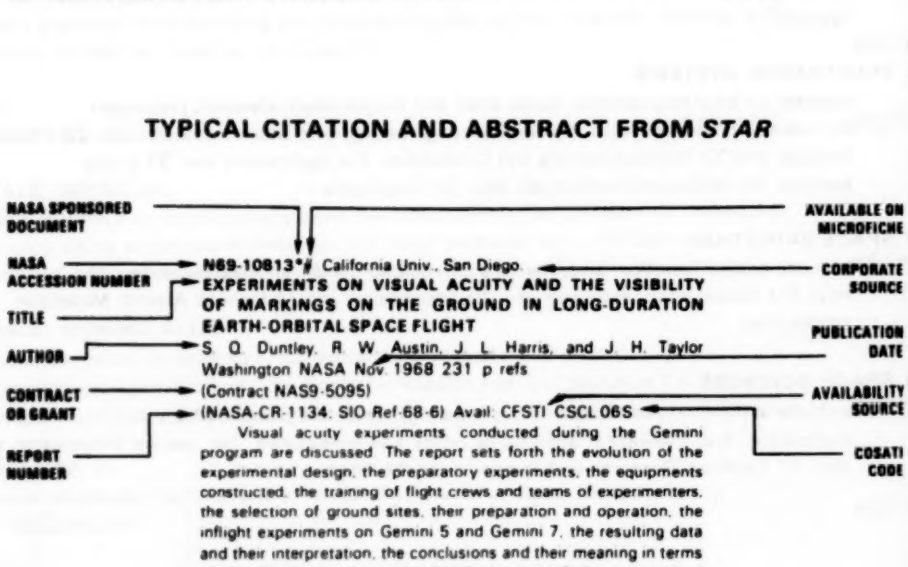
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N69-10813*# California Univ., San Diego
EXPERIMENTS ON VISUAL ACUITY AND THE VISIBILITY OF MARKINGS ON THE GROUND IN LONG-DURATION EARTH-ORBITAL SPACE FLIGHT
S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
Washington NASA Nov. 1968 231 p refs
(Contract NAS9-5095)
(NASA-CR-1134, SIO Ref-68-6) Avail: CFSTI CSCL 06S
Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space.
Author

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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N69-40026*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SUPERSONIC LIFTING CAPABILITIES OF LARGE-ANGLE CONES

James F. Campbell and Dorothy T. Howell Washington Oct. 1969 66 p refs

(NASA-TN-D-5499) Avail: CFSTI CSCL 01A

Experimental data were obtained on wind-tunnel models at Mach numbers from 1.41 to 4.63 for a Reynolds number of 0.8×10^6 based on model base diameter. Cone semiapex angles ranged from 40° to 90° (disk). Results indicated that transverse displacement of the center of gravity vertically from the vehicle longitudinal center line is an effective method of producing trim lift on large-angle cones, the trim lifting capability increasing with increase in cone semiapex angle. An increase in cone semiapex angle decreases the transverse center-of-gravity displacement required to achieve a given value of trim lift-drag ratio, and correspondingly lowers trim angle of attack, and increases trim drag. Transverse displacement of the center of gravity up to 4 percent of the base diameter from the longitudinal center line results in continual decreases in trim drag to values that are about 80 percent of the trim drag obtained for the center of gravity located on the longitudinal center line. For all combinations of cone semiapex angle and transverse center-of-gravity location, trim drag is essentially constant at Mach numbers greater than 2. Rearward longitudinal displacement of the center of gravity from the cone base to 10 percent of the base diameter has little or no effect on the trim aerodynamic characteristics obtained by transverse center-of-gravity shift for cones with semiapex angles equal to or greater than 70°. Author

N69-40100*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN ANALYTICAL METHOD FOR PREDICTING THE LIFT AND DRAG FOR SLENDER SHARP-EDGE DELTA WINGS IN GROUND PROXIMITY

Charles Harry Fox, Jr. (M.S. Thesis Va. Polytech. Inst.) Mar. 1969 55 p refs

(NASA-TM-X-61903) Avail: CFSTI CSCL 01A

A potential flow lifting surface method is combined with a vortex lift concept and applied to slender sharp-edge delta wings. A multihorseshoe vortex lattice method incorporating an image technique is used to compute the potential flow normal force and axial force characteristics of delta wings in ground proximity. A free-air vortex lift concept based on a leading edge suction analogy is utilized to account for the lift increment due to the leading edge spiral vortex. A method is developed for combining the free air vortex lift concept with the results of the potential flow theory in ground proximity. Theoretical and experimental lift and drag for delta wings having a wide range of aspect ratios at selected angles of attack are compared. This method provides a reasonably good prediction of the lift and drag in ground proximity for aspect ratios less than two in the angle-of-attack range from approximately 5° to 16°. Author

N69-40129*# Pratt and Whitney Aircraft, East Hartford, Conn.

EXPERIMENTAL EVALUATION OF TRANSONIC STATORS Final Report

M. J. Keenan and J. A. Bartok 1969 96 p refs

(Contract NAS3-7614)

(NASA-CR-72298; PWA-3470) Avail: CFSTI CSCL 01A

Blade element performance of compressor stators designed to operate in the transonic Mach number range was investigated. Two multiple-circular-arc (MCA) stators, one double-circular-arc (DCA) stator and one slotted multiple-circular-arc stator with design diffusion factors in the range of 0.6 at the hub to 0.5 at the tip were tested to determine the effects of blade airfoil shape and slots on performance. Total pressure loss levels in end regions for all stators were predominantly higher than those at midspan. It is believed that the high end wall losses overshadowed differences in loss levels due to different profile shapes. The loss level measured in the mid-span region of the multiple-circular-arc stators when operated at the transonic Mach number range was lower than that of the double-circular-arc stator. Slotting of the MCA stator A to discharge high-energy air at the point of shock impingement on the suction surface showed no reduction of loss or increase in turning over the unslotted configuration. Author

N69-40268# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

OSCILLATORY PRESSURE MEASUREMENTS ON A FLEXIBLE SLENDER-WING MODEL AT LOW SUBSONIC SPEEDS

F. Ruddlesden, D. A. Drane, and P. W. Slaven Aeron. Res. Council 1969 35 p refs Supersedes RAE-TR-67316; ARC-30401

(ARC-R/M-3596; RAE-TR-67316; ARC-30401) Copyright. Avail: CFSTI; HMSO: 18s 6d

Oscillatory pressure measurements have been made on a flexible slender-wing model in a low subsonic speed wind tunnel. The model was vibrated at 5 Hz in a single longitudinal bending mode, and measurements were taken at wind speeds of 140, 180 and 220ft/s(43.55 and 67m/s) from 24 pressure transducers installed in one half of the model. Corresponding values of oscillatory pressures were calculated for comparison with those measured. It is shown that over the broad area of the wing there is good agreement between theory and experiment within the range of frequency parameters investigated. Near the apex of the wing shortcomings inherent in the theory may account for the discrepancies observed between theory and experiment. Author (ESRO)

N69-40345*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

WIND-TUNNEL INVESTIGATION OF THE AERODYNAMIC

PRESSURES ON THE APOLLO COMMAND MODULE CONFIGURATION

William C. Moseley, Jr. and B. J. Wells (Federal Electric Corp., Houston, Tex.) Washington Oct. 1969 76 p refs

(NASA-TN-D-5514) Avail: CFSTI CSCL 01A

A program of wind-tunnel tests was conducted at Mach numbers from 0.4 to 19.0 to determine the pressure distribution of the Apollo command module. Data are presented for the angle-of-attack range from 0° to 180°. Results of these tests are presented as pressure coefficients plotted against the physical positions of the orifices. Author

N69-40425# Compagnie de Recherches et d'Etudes Aeronautiques, Paris (France).

CALCULATION OF THE PERFORMANCES OF A SUPERCAVITATING PROPELLER (SIGMA EQUALS 0.4) FOR DIFFERENT ADVANCE COEFFICIENTS (J)—CONFRONTATION, THEORY, EXPERIMENT Final Scientific Report

T. S. Luu and P. Sulmont. 15 Jul. 1969 26 p refs

(Contract G61052-68-C-0074)

(AD-691821) Avail: CFSTI CSCL 13/10

The study is limited to the utilization of a simplified theoretical schema: the propeller is considered as a lifting line with the hypothesis that each section of the blade functions like a two-dimensional supercavitating cascade. This schematic arrangement of the lifting line requires taking into account velocities induced by the helicoidal vortex wakes emitted on the trailing edges of the blades. Taking into account these induced velocities, the circulation distribution along the radius of the blade is determined. Author (TAB)

N69-40444# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.

THE STABILITY OF SPHERICAL BLAST WAVES

Richard A. Gerwin and Richard B. Hall Jun. 1968 47 p refs

(AD-691301; D1-82-0858) Avail: CFSTI CSCL 20/14

The stability of strong spherical blast waves to infinitesimal perturbations is examined in the limit (gamma-1) $\ll$ 1, where gamma is the ratio of specific heats. By making a thin sheet approximation to the geometry it is found possible to describe all perturbations as a sum of spherical harmonics. By transforming to a new time-like variable, one can obtain a set of ordinary constant-coefficient differential equations for the perturbation corresponding to each spherical harmonic, and one then obtains a dispersion relation giving the growth rate of each harmonic. Author (TAB)

N69-40513# Royal Aircraft Establishment, Bedford (England). Aero/T Dept.

THE PERFORMANCE OF SOME AXI-SYMMETRIC ISENTROPIC CENTREBODY INTAKES DESIGNED FOR MACH NUMBERS OF 2.48 AND 3.27

E. L. Goldsmith and G. V. F. Smith. HMSO 1969 185 p refs Supersedes RAE-TR-66209

(ARC-R/M-3585, RAE-TR-66209) Copyright. Avail: CFSTI

An experimental investigation of the pressure recovery and drag characteristics of two series of isentropic centrebody intakes (designed for Mach numbers of 2.48 and 3.27 respectively) has been made at zero incidence and over the Mach number range from 2.14 to 3.27. At the design Mach numbers experimental results have been compared with calculated values of drag at full mass flow and estimates of shock pressure recovery. Approximate methods have been devised to predict the variation of full mass flow and drag with Mach number at below design values. The correlation of experimental pressure recovery with intake geometry for conical centrebody intakes published in an earlier paper has been revised and generalised. It can now be used for all axi-symmetric centrebody designs utilising external compression and internal contraction up to the maximum permissible for 'starting' (without variable geometry). Author (ESRO)

N69-40560# Aeronautical Research Council (Gt. Brit.)

COMPARISON OF THREE METHODS FOR THE EVALUATION OF SUBSONIC LIFTING-SURFACE THEORY

H. C. Garner (Natl. Phys. Lab., Teddington), B. L. Hewitt (Brit. Aircraft Corp.), and T. E. Labrujere (Natl. Aerospace Lab., Neth.) 1969 43 p refs Supersedes NPL-AERO-1272; ARC-30324

(ARC-R/M-3597; NPL-AERO-1272; ARC-30324) Copyright. Avail: CFSTI; HMSO: 19s

Independent numerical methods for obtaining the subsonic load distribution on a thin wing of arbitrary twist and camber have been developed at NPL, NLR (Netherlands) and BAC (Warton). The three methods have been studied jointly and their novel features have been reviewed critically. The best solutions by each method show excellent agreement for wings, at uniform incidence, having smooth leading and trailing edges. Spanwise loading, local aerodynamic centres, lift, pitching moment, vortex drag and chordwise loadings are tabulated for circular and rectangular planforms, for a wing of constant chord with hyperbolic leading and trailing edges, and for a tapered sweptback wing. The convergence of the solutions is examined in detail with respect to separate parameters representing the numbers of spanwise integration points and spanwise and chordwise collocation points. The tapered sweptback planform is considered with different amounts and types of artificial central rounding, but the crucial problem of a central kink under lifting conditions remains a subject for research. Author (ESRO)

N69-40599# National Physical Lab., Teddington (England). Aerodynamics Div.

THE AERODYNAMIC INVESTIGATION FOR A PROPOSED CONVEYOR BRIDGE OVER HOLYHEAD HARBOUR

D. E. Walshe and D. C. Isles (Freeman, Fox and Partners) Mar. 1969 28 p refs

(NPL-AERO-SR-023) Avail: CFSTI

Tests were made to determine the aerodynamic stability characteristics of a proposed design for a cable-stayed, box-girder bridge carrying a conveyor belt. The bridge was found to be subject to strong vortex excitation, and to galloping at higher wind speeds. Comparison was made of its behaviour in wind with the behaviour of a rectangular box. Vortex generators fitted to the model girder promoted stability. Author (ESRO)

N69-40876*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PRESSURE DISTRIBUTION OF A LARGE SEMISPAN TILTING WING WITH 0.4-DIAMETER-CHORD, SINGLE-SLOTTED FLAP, AND A SINGLE PROPELLER 0.22 CHORD BELOW WING

Marvin P. Fink and Charles C. Smith, Jr. Washington Oct. 1969 380 p refs

(NASA-TN-D-5481) Avail: CFSTI CSCL 01A

The model consisted of a semispan wing-propeller combination and half fuselage. The tests were made for both up-at-the-tip modes of propeller rotation, with and without a leading edge slat and with and without fences. The tests consisted of the measurement of the wing surface pressures over a range of angles of attack from 5° to 80° for thrust coefficients of 0.90, 0.80, 0.60, and 0.30 for flap deflections at 0°, 20°, 40°, and 60°. The data are presented in tabulated form with only a minimum of analysis. Author

N69-40928*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DETERMINATION OF THE SHAPE AND INERTIAL PROPERTIES OF AN ALL-FLEXIBLE PARAWING

Blair Bradley Gloss (M.S. Thesis--Va. Polytech. Inst.) May 1969 65 p refs

(NASA-TM-X-61907) Avail: CFSTI CSCL 01A

An investigation was conducted in the 17-foot test section of the 7- by 10-foot 300-MPH wind-tunnel to determine the shape of a 5-foot long, 45°-swept, single-keel, all-flexible parawing. A stereo-optic camera system was used to obtain shape data at lift-drag ratios of 2.429, 2.241, and 2.131. These data were used to calculate nondimensional moments of inertia, nondimensional products of inertia, and nondimensional center-of-gravity locations for the canopy alone and the suspension lines alone at lift-drag ratios of 2.429, 2.241, and 2.131. No estimates or calculations of moments of inertia were made for the apparent mass of the parawing system. Author

N69-40995# Rensselaer Polytechnic Inst., Troy, N.Y.
PROJECT TUBEFLIGHT: FAR-FIELD AERODYNAMICS OF TUBEFLIGHT PROPULSION
Joseph V. Foa Jan. 1969 35 p refs
(Contract C-117-66)
(TR-PT-6903) Avail: Issuing Activity

A method is developed for the coupling and solution of the equations governing the flow field for the case of a tubeflight vehicle in steady motion in a very long tube. The method produces useful information on the interrelationships between the speed of travel, the drag of the vehicle, the amplitude of the flow disturbances in the far field, the energy conversion efficiency of the thrust generator, and the power demands. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N69-40030*# California Univ., Davis. Dept. of Mechanical Engineering.
CONTROL POWER REQUIREMENTS OF VTOL AIRCRAFT Quarterly Status Report, 1 Jul. 30 Sep. 1969
Myron A. Hoffman 30 Sep. 1969 5 p
(Grant NGR-05-004-051)
(NASA-CR-106352; QSR-2) Avail: CFSTI CSCL 01C

An alternate control system is proposed using a modal controller in an inner loop for stabilizing the aircraft, and a decoupling controller in an outer loop for facilitating the flight path control. The system is applicable to hover, transition, and cruising flight. Advantages expected from the system are rapid, positive response for nullifying the effect of gust disturbances, a reduction of the pilot's or autopilot's workload, and increased freedom to follow simplistic design procedures in order to produce a high performance flight control system. A schematic diagram of this concept is included. A cost program for pure jet lift VTOL aircraft, and a moment of inertia subroutine are mentioned. M.H.E.

N69-40045*# Martin Marietta Corp., Denver, Colo.
DIGITAL AUTOPILOT DESIGN AND COMPUTER SIZING STUDY Final Technical Report
Peter G. Brabeck, John H. Burrell, Darrell K. Houser, Richard S. Jackson, Michael L. Salis, et al. Cambridge, Mass. NASA Electronics Research Center Sep. 1969 264 p refs
(Contract NAS12-2048)
(NASA-CR-86246) Avail: CFSTI CSCL 01D

This report describes the approach used to design the digital flight control system for vehicles typical of the type to be used in the varied space technology of the next decade (Atlas/Centaur, Atlas/Burner II, Saturn IB/Centaur, and Saturn V/Voyager). The analysis and design of the digital autopilot gains and filters needed for vehicle stabilization lead to the development of a single software package capable of accommodating the flight control requirements of any or all of the vehicles mentioned. A comprehensive description of this software mechanization together with timing, sizing, and input/output (I/O) requirements for the system are presented. Finally, results obtained from a hybrid real-time simulation of the system for each vehicle are discussed; these results demonstrate the capability and performance of the single flight control system. Author

N69-40101*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INVESTIGATION OF THE EFFECTS OF ROLL-SPIRAL COUPLING ON THE LATERAL-DIRECTIONAL HANDLING QUALITIES OF A STOL SUBSONIC TRANSPORT
Frederick Lyle Moore (M.S. Thesis, Va. Polytech. Inst.) [1969] 71 p refs
(NASA-TM-X-61898) Avail: CFSTI CSCL 01C

For certain new types of aircraft, such as the supersonic transport and V/STOL configurations, an unusual lateral mode of motion is expected to be present. This mode of motion is found when the conventional roll and spiral modes of motion couple and form a second lateral oscillation in addition to the Dutch roll oscillation. The present work deals with the effects of the roll-spiral coupled mode of motion on the lateral-directional handling characteristics of a hypothetical subsonic STOL transport aircraft. The investigation consisted of a general analysis and analytical calculations of the lateral dynamics for configurations of the transport having various types of roll-spiral oscillations. Also, a fixed-base simulator study was conducted in order to obtain pilot evaluation of the handling qualities of the various configurations under instrument flight rules (IFR) conditions. The results of the simulator study indicate that the hypothetical transport could have acceptable qualities with a roll-spiral coupled oscillation present provided small lateral inputs are used. Author

N69-40112 National Lending Library for Science and Technology, Boston Spa (England).
CONTRIBUTION TO THE SHAPING OF INTAKES OF LIFETIME ENGINES
Jurgen Barche 1 May 1969 24 p refs Transl. into ENGLISH from Z. Flugwiss. (Ger.), v. 15, no. 3, 1967 p. 95 - 100
(NLL-T-6233-(5809.95)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A method is proposed for the calculation of intakes of lift engines. This method is based on the determination of plane constant pressure contours which are determined by means of hodograph mapping, and extended to the three-dimensional intake by a simple interpolation formula. Experiments have shown that such intakes are practical. Author

N69-40188# RAND Corp., Santa Monica, Calif.
INDICATORS OF THE EFFECT OF JET NOISE ON THE VALUE OF REAL ESTATE
Paul T. McClure Jul. 1969 38 p refs
(AD-690827; P-4117) Avail: CFSTI CSCL 20/1

Airport neighbors typically contend that their property should enjoy airport-accelerated appreciation in value but not suffer counterbalancing effects from jet noise. The paper discusses the effect of jet noise on property value as indicated by (1) market value changes, (2) insulation costs, (3) easement costs, and (4) litigation. Author (TAB)

N69-40336# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDRAULIC UNIT WITH CYCLOGRAM CONTROL FOR SCAVENGING AIRCRAFT HYDRAULIC SYSTEMS

A. I. Privalov et al. 4 Jun. 1969 17 p Transl. into ENGLISH from Russian Patent no. 205618 (Appl. no. 1024179/40-23, 26 Aug. 1965), 3 p
(AD-692139; FTD-HT-23-123-69) Avail: CFSTI CSCL 13/7

The patent involves a hydraulic unit with cyclogram control for breaking in aircraft hydraulic systems, consisting of a hydraulic pump located on a hydraulic tank, intake and pressure lines with filters, return valves, measuring devices, on-board sockets, a radiator, and a hydraulic accumulator connected to the intake line. To automate the measuring device of the hydraulic system in the aircraft being inspected, after the hydraulic system has been broken in at a given pressure, and to automatically replace the working fluid while removing air from the aircrafts hydraulic system, the unit is equipped with a discharge line connected through an electromagnetic valve to the intake line and through a safety valve to the hydraulic tank; an intermediate pressure line is connected through the measuring device and the electromagnetic valve to the compressor line, and through a throttle to the intake line. At this point in the intake line are placed low and high-pressure indicators, which the booster pump switches on and off when certain pressure limits are attained. Author (TAB)

N69-40338# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
DYNAMIC TEST CRITERIA FOR AIRCRAFT SEATS Final Report
Donald W. Voyls Oct. 1969 117 p refs
(NA-69-5, DS-69-10) Avail: CFSTI

A series of static and dynamic tests of representative aircraft passenger seats was conducted. The dynamic tests utilized, in part, test procedures developed specifically for this project and, in part, test procedures developed from experience in the testing of Navy aircrew seats. A significant difference between static and dynamic test results was found. The fact that static test results, in themselves, cannot be related to crash environments is demonstrated and cited as a definite limitation of static tests. Dynamic test results are demonstrated as having the capability of being related to crash environments. Dynamic test criteria for the type certification of aircraft seats were established and used to analyze the static and dynamic test results. A relationship between the static and dynamic test load conditions was devised as part of the criteria. Relatively simple methods for dynamic testing are suggested, and the procedure of analyzing test results is presented. Author

N69-40363# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
STUDY OF AN ELECTRICALLY PROPELLED, HIGH-SPEED, AIR-CUSHION AMPHIBIAN Research Report, Jun. – Dec. 1968
Dietrich J. Roesler May 1969 107 p refs
(AD-691724; USAMERDC-1949) Avail: CFSTI CSCL 13/6

The report covers a study on an electrically propelled air-cushion amphibian capable of moving a 20-ton container and/or bulk cargo. The combination of wheel traction and air-cushion lift gives this amphibian unique capabilities. These capabilities include: High water and land speed; cross-country mobility; east positioning; equal load distribution over the whole length of the vehicle, thus permitting crossing of bridges that would otherwise require strengthening or rebuilding; independent four-wheel drive for maximum vehicle control on land. The purpose of the report is to point out that electric propulsion can be readily adapted to special propulsion systems and requirements even under circumstances where other propulsion systems would not be practical anymore. Author (TAB)

N69-40419# Aerospace Corp., El Segundo, Calif.
ON STREAMLINING VEHICLES FOR HIGH ALTITUDE HYPERSONIC FLIGHT
John W. Ellinwood 29 Jul. 1969 17 p refs
(Contract F04701-69-C-0066)
(AD-691817; SAMSO-TR-69-235, TR-0066(5240-10)-2) Avail: CFSTI CSCL 1/2

Drag minimization at a given flight condition in the near-continuum flow regime (Mach number over root of Reynolds number near 0.1) is discussed by examining recent theory and data for slender unyawed cones. For applications where the flight conditions excompass a semi-infinite portion of the transitional flow regime, a first-order estimate is presented of an average condition at which to design for minimal drag. The estimate depends on the drag coefficient curve, but not on the trajectory or atmospheric details. Author (TAB)

N69-40424# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TEMPERATURE FIELDS IN FLIGHT STRUCTURES COMPUTATIONAL METHODS
V. S. Zarubin 20 Mar. 1969 205 p refs Transl. into ENGLISH from the Russian
(AD-691372; FTD-HT-23-351-68) Avail: CFSTI CSCL 1/3

This book is intended for engineers, as well as for graduate and undergraduate students of higher technical schools, who are familiar with the principles of heat transfer and whose specialty is related to the calculation of the thermal and structural strength of aircraft and of aircraft engines. Material presented includes: finding temperature fields in the thin-walled elements which are commonly found in aircraft and engines; operative formulas; reference tables and graphs; illustration of computation methods using arbitrary data; frontiers of experimental research in the temperature fields. Author (TAB)

N69-40439*# Lockheed-Georgia Co., Marietta.
EFFECT OF JET TEMPERATURE ON JET AND PURE TONE NOISE RADIATION
Harry E. Plumblee, George A. Wynne, and Ben T. Zinn Washington NASA Nov. 1969 73 p refs
(Contract NAS1-8443)
(NASA-CR-1472) Avail: CFSTI CSCL 01C

A model jet nozzle was tested over a temperature range of 540°R to 1100°R, and sound pressure was measured at enough positions in the far field to calculate sound power. From these tests, the effect of temperature on total sound power was isolated. A prediction technique for sound pressure was modified to sound power and was verified over the temperature test range of this program. The prediction method was then used to determine the effect of temperature, as high as 3500°R, on radiated sound power. It was determined that jet sound power is a nonlinear function of temperature. At high temperatures, significant reductions in jet noise may be achieved. The changes in fan noise characteristics were also measured as the noise propagates through a high-temperature region in the fan duct and subsequently radiates into an ambient medium. It was shown that increasing temperature increases higher-order acoustic duct mode cut-on frequencies. Increasing temperature possibly reduces radiated pure tone noise. Design studies were made concerning the changes required to modify an existing engine to test the jet-heating concept. A combustion instability analysis for annular duct geometry was performed and used in designing components such as the combustion chamber and flameholders, to reduce high frequency combustion instability. Author

N69-40476# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
AN EXPERIMENTAL STUDY OF PILOT VISIBILITY FROM A VTOL AIRCRAFT IN OVERWATER HOVER
George Kurylowich and Alfred Ritter Apr. 1969 58 p refs
(Contract N00014-68-C-0241)
(AD-691299; CAL-171) Avail: CFSTI CSCL 1/3

A test program which investigated in small scale the phenomenon of spray generation and the resulting impairment to

pilot vision when an in-line VTOL configuration, such as the LTV XC-142A, is in low-altitude overwater hover is described. Also given are the improvements to pilot vision when deflectors are used to divert the spray from principal regions of interest to a pilot. A device in close proximity to the fuselage is, at best, only locally effective. The major conclusion is that a deflector positioned at the water surface cavity produced by the slipstreams of the propellers can be very effective in reducing spray. The use of such a deflector, however, may present potential problems affecting hover performance and spray ingestion through the propeller plane.
Author (TAB)

N69-40702# British Air Line Pilots Association, Hayes (England).
AUTOMATION, SIMULATION AND DATA HANDLING IN CIVIL AVIATION BALPA Technical Symposium
1968 190 p Proc. of 5th Ann. BALPA Tech. Symp., held 26–28 Nov. 1968
(C-171) Avail: CFSTI

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7. AUTOMATIC AIR-GROUND COMMUNICATIONS BY DIGITAL DATA LINK C. L. Hynam (Decca Navigator Co., Ltd., London, Engl.) p 102–108 (See N69-40709 24-07)

8. AUTOMATED PROCEDURES USED IN PREPARING OPERATIONAL AVIATION FORECASTS J. E. McDonell (Weather Bur., Wash., D.C.) p 115–126 (See N69-40710 24-20)

9. FUTURE TRENDS IN AIRCRAFT SIMULATION G. A. Allred (United Air Lines, Chicago, Ill.) p 133–138 (See N69-40711 24-02)

10. THE SCOPE OF COMPUTERS IN AN AIR LINE A. Jacobs (Brit. Overseas Airways Corp.) p 146–151 (See N69-40712 24-07)

11. THE AIRPORT AND AUTOMATION J. D. Perret (Brit. Airports Authority, London, Engl.) p 155–161 (See N69-40713 24-11)

N69-40704# Bendix Corp., Detroit, Mich.
AUTOMATIC FLIGHT CONTROL SYSTEMS—MAINTAINABILITY BY DESIGN
J. E. Leggett and R. Sellite *In* Brit. Air Line Pilots Assoc. Automation, Simulation and Data Handling in Civil Aviation 1968 p 11–28 (See N69-40702 24-02)
Avail: CFSTI

The following maintainability characteristics that relate to mission success are treated: (1) equipment failure rate; (2) time required for fault detection and isolation; and (3) time required to make the necessary repairs. A theoretical airline operation, consisting of 200 aircraft operating between 40 stations with a mission time of five hours per flight, is considered. Mission success or failure is expressed as a probability function, and the effects of applying automatic flight control systems on the failure rate are determined. It is concluded that the implementation of integrated circuit technology will result in the ability to perform more complex flight guidance functions with increasing system reliability. A.C.R.

N69-40705# Rolls-Royce, Ltd., Derby (England).
NEW PHILOSOPHIES IN AUTOMATIC POWER UNIT CONTROLS
E. S. Eccles *In* Brit. Air Line Pilots Assoc. Automation, Simulation and Data Handling in Civil Aviation 1968 p 33–43 (See N69-40702 24-02)
Avail: CFSTI

New control philosophies using digital computers are analyzed, based on a study of such techniques in relation to engine control. Three basic principles that should be fundamental to all automatic systems are identified, and the efficient use of the digital system is then treated as it relates to aircraft safety and reliability requirements. The concept of integrated propulsion control in which a single, redundant, multi-computer system is used to insure all safety and flight control specifications is described in detail. Particular emphasis is placed on more advanced operations, where a thrust management system gives a single-power level that can actually be regarded as a fourth flying control. It is concluded that future applications must not only be concerned with control over automatic functions of the aircraft, but also with the decision-making process and the integration of systems and human operators. Any expansion of services, however, must be matched by reduced accident rates; it is proposed that automatic systems will meet this requirement in all areas of aircraft operation due to the higher predictability of machine over human performance. A.C.R.

N69-40706# Lockheed Aircraft International A.G., Geneva (Switzerland).
AN AIRBORNE MANUAL/AUTOMATIC MALFUNCTION DETECTION SYSTEM
J. W. Baird *In* Brit. Air Line Pilots Assoc. Automation, Simulation and Data Handling in Civil Aviation 1968 p 49–59 (See N69-40702 24-02)
Avail: CFSTI

Hardware design and operation of the C-5A Malfunction Detection, Analysis, and Recording System is described. Two subsystems—automatic and manual—share the printout unit and maintenance data recorder for record keeping. The automatic portion operates whenever the switch is turned on, with the manual portion being used at the discretion of the operator. The automatic mode monitors line replaceable units which have signal data outputs amenable to digital techniques. Data sampling, value comparison, limit detection, and malfunction printout are performed automatically according to a pre-programmed scheme. Results of airborne and laboratory tests of the system indicate that the hardware is sound, and its application to the C-5 aircraft is reasonable. Engine test stand performance included detection of a failure 30 minutes before it became apparent to the test crew. A.C.R.

N69-40707# Board of Trade, London (England). National Air Traffic Control Services.
CURRENT AIRBORNE COLLISION AVOIDANCE PROPOSALS AND ALTERNATIVE METHODS OF ATTACK ON THE BASIC PROBLEM
E. J. Dickie and J. H. Briggs (Min. of Technol.) *In* Brit. Air Line Pilots Assoc. Automation, Simulation and Data Handling in Civil Aviation 1968 p 68–80 Prepared jointly by Board of Trade and Min. of Technol. (See N69-40702 24-02)
Avail: CFSTI

Several systems proposed in the United Kingdom are discussed for four types of airspace: (1) the airways system; (2) the upper air; (3) the North Atlantic; and (4) the remaining areas for routing air traffic. The aim is to provide a control service capable of

maintaining safety without unduly interfering with traffic flow; such a system must be completely cooperative between aircraft and capable of operating within the existing air traffic control network. The technical basis is identified as the Time/Frequency method, which uses an extremely reliable and accurate clock to define the time of origin of a transmission from one location and to measure the time of arrival at another; as a result of this timed transmission, the range between the two objects can be determined to avoid possible collision between aircraft on similar courses. Since this technique is only capable of measuring range and range rate, an approach to insuring the proper altitude separation is also treated. Finally, additional complications in the vicinity of the busiest terminals are mentioned, and it is concluded that reduction of the collision danger in such areas requires improvement in the overall aircraft/ground monitoring and control system. A.C.R.

N69-40711# United Air Lines, Inc., Chicago, Ill.
FUTURE TRENDS IN AIRCRAFT SIMULATION
G. A. Allred. *In* Brit. Air Line Pilots Assoc. Automation, Simulation and Data Handling in Civil Aviation 1968 p 133-138 (See N69-40702 24-02)
Avail: CFSTI

Future capabilities of ground-based simulators and problems involved in their development are discussed. Although existing equipment appears to adequately simulate environment and to present flight instrumentation accurately and in proper relationship to engine performance, lack of lateral translation in the motion system requires correction for 100% capability. A probable solution is the introduction of a six-degree-of-freedom system in the near future, which allows for motion along and translation about the vertical, longitudinal, and lateral axes. Improvements required in the visual systems are divided into four basic types: (1) television image generation; (2) use of color motion pictures for image generation; (3) optical/form models; and (4) systems in the early design stage, including computerized or digitized image-generation techniques. It is emphasized that progressive simulator programs will be required in the future to insure that training is not less difficult, and in some cases more difficult, than the aircraft being mastered. Mention is also made of recent developments in the variable-stability aircraft, often referred to as a total in-flight simulator. A.C.R.

N69-40743*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
MANUAL CONTROL OF UNSTABLE VEHICLES USING KINESTHETIC CUES
Philip L. Noggle. Jun. 1969 123 p refs
(Grant NGR-22-009-025)
(NASA-CR-106370; MV-69-4) Avail: CFSTI CSCL 01C

A control stick was constructed which sensed the operator's force but moved only in response to an external electrical signal, giving the operator kinesthetic cues. First and second order plants were used in experiments which compared human operators' ability to control instabilities with the force sensing stick fixed, driven by plant position, and driven by plant velocity. Great improvement in human control capability were found in controlling first order plants with the stick driven by plant position and in controlling second order plants with the stick driven by plant velocity. The necessity for lead was reduced by providing the operator with a signal, in the form of stick motion, with the proper phase for stabilization. The dealy time was reduced by enabling the operator to transmit the stabilizing signal to the plant by stick reaction forces determined by muscle tensing instead of voluntary action. Author

N69-40774# Tactical Airlift Center, Pope AFB, N.C. Office of Operations Analysis.
A COMPUTER PROGRAM FOR DETERMINING THE TRAJECTORY AND PLATFORM ATTACK ANGLE OF A LAPES PLATFORM DURING FREE FALL
David A. Link. Jun. 1969 20 p refs
(AD-691436; TALC-OA-TM-3) Avail: CFSTI CSCL 1/2

This memorandum contains a dynamic analysis of the free-fall portion of the LAPES trajectory. The analysis was made in response to a request for a more exact method for locating the attitude control bar for unusual single-platform loads, such as vehicles. Results are presented in the form of a program in the Continuous System Modeling Program (CSMP) language for solving the equations of motion and graphs for an example calculation. Author (TAB)

N69-40922# Federal Aviation Administration, Oklahoma City, Okla. National Flight Inspection Div.
EVALUATION OF ENROUTE PROCEDURES STANDARDS Project Report
Harold R. Richards and Frank Parr. Washington Sep. 1969 70 p
Avail: Issuing Activity

Data were recorded from 658 aircraft in the enroute IFR environment. Aircraft samples included Air Carrier, Military, and General Aviation operations. Altitudes of aircraft sampled ranged from the Minimum Enroute Altitude (MEA) through Flight Level (FL) 450. Electronic radials were checked before, during, and after data acquisition periods. Deviations from airway/route radials were analyzed statistically to determine mean and standard deviation. Data were found to be normally distributed. Deviation from centerline was not affected by aircraft category (air carrier, military, or general aviation). Deviations increased as distance from the navigation facility increased. Deviations were affected by altitude groupings (above or below FL-180). Flight Technical Error (pilotage factor) was found to be linear rather than angular. It was determined that present airspace structure for enroute airways/routes could be modified with substantial savings in airspace. Author

N69-40937*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF A TECHNIQUE FOR DETERMINING AIRPLANE AILERON EFFECTIVENESS AND ROLL RATE BY USING AN AEROELASTICALLY SCALED MODEL
Irving Abel. Washington Nov. 1969 40 p refs
(NASA-TN-D-5538; L-6695) Avail: CFSTI CSCL 01C

Wind-tunnel studies of an aeroelastically and dynamically scaled model of a multijet cargo airplane have been conducted to measure aileron-control characteristics at Mach numbers up to 0.93. A successful technique has been demonstrated for determining the aileron effectiveness, reversal boundary, and flight roll rates below the reversal boundary based on measured values of damping in roll. Author

N69-41000# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BETWEEN THE STRATOSPHERE AND SPACE. 1. HYPERSONIC AIRCRAFT AND ENGINES
G. Nesterenko. 6 Jun. 1969 15 p Transl. into ENGLISH Kryl'ya Rodiny (Moscow), v. 19, no. 9, 1968 p 26-27
(AD-691670; FTD-MT-24-57-69) Avail: CFSTI CSCL 1/3

A general review is presented of hypersonic vehicles and associated propulsion systems. Although the review is based on foreign literature sources, it is pointed out that scientists and designers are looking into the problem of space aviation development. Modern science and technology is sufficiently advanced to develop vehicles for speeds ranging from 3,000 to 28,000 km/hr, at altitudes of 35 to 150 km. Beginning with this issue, the author will publish a series of articles dealing with hypersonic flights. Author (TAB)

N69-41102*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
A DESIGN STUDY OF A METROPOLITAN AIR TRANSIT SYSTEM
Aug. 1969 301 p refs

(Contract NSR-05-020-151)
(NASA-CR-73362; SUDAAR-387) Avail: CFSTI CSCL 01C

A proposed metropolitan air transit (MAT) system is described in detail to serve a 13-county region in the San Francisco Bay area, although the concept is adaptable to any urban location. The 24 terminals to be established are located in city centers, the major Bay area airports, and in suburban population centers. The system is to begin operation in 1980 and reach full-scale operation by 1990. The aircraft, flying at altitudes no more than 2000 feet above ground level, will be fully automatic from startup to shutdown. In areas of dense air traffic either commercial or general aviation, tube-like traffic corridors will be reserved. An 80-passenger compound helicopter configuration with a gross weight of about 60,000 pounds was selected. The rotor is utilized for takeoff and landing; under cruising conditions, lift is provided by a standard wing and forward propulsion by two, high by-pass ratio, turbo fan engines especially designed for low noise level. The 24 terminals can handle 100,000 commuter trips and 50,000 airline connection trips per day, with a peak hourly load of 9300 passengers. Cost analysis indicated that the MAT system feasible provided that the aircraft are utilized at least 2000 hours per year, assuming a load factor of 50%. At this utilization rate, the total cost of operation for the full system is estimated at about $0.17 per passenger mile.
A.C.R.

N69-41147# National Transportation Safety Board, Washington, D.C.
BRIEFS OF ACCIDENTS: U.S. CIVIL AVIATION
Sep. 1969 345 p *Its* Issue No. 6
Avail: CFSTI

Reports of U.S. civil aircraft accidents are presented in brief format, as reproduced from the coded magnetic tape record by EDP equipment. The cause factor, type of accident, and operational phase in which the accident occurred are included. Collisions between aircraft are treated as one accident, and a complete analysis of each vehicle involved in the collision is given.
A.C.R.

N69-41347# Road Research Lab., Crowthorne (England).
TYRE IMPACT TESTS ON AIRPORT LANDING LIGHTS
T. Williams 1968 17 p
(PB-183610; RRL-LR204) Avail: CFSTI CSCL 13L

Measurements were made of impact factors for a 35 × 10 × 17 in. aircraft wheel rolling over a selection of airfield landing lights, the impact factor being the maximum dynamic load due to the impact with the landing light divided by the normal load just prior to impact. Wooden models were used to simulate the shapes of the landing lights and the change in load was measured at different speeds on the strain gauged axle of the test wheel of the heavy load vehicle. The impact factor was found to vary with the mean obstruction height of the model and the tire spring rate, as predicted by theoretical studies, both an increase in height and inflation pressure increasing the impact factor. Author (USGRDR)

N69-41360# Hughes Tool Co., Culver City, Calif. Aircraft Div.
COST-EFFECTIVENESS SENSITIVITY OF V/STOL MAJOR SUBSYSTEM DESIGN TO OPERATIONAL AVAILABILITY/UTILIZATION PAIRS
Michael A. Leone Oct. 1969 20 p refs
(HTC-AD-69-85) Avail: CFSTI

The measure of cost effectiveness of a V/STOL aircraft system is investigated in relation to its ability to perform an assigned logistic mission. It is shown that the operational availability of assigned equipment in combat reflects the commander's ability to respond to peak requirements while continuing to operate his equipment at some average utilization rate, and that operational availability is a synergistic function related to both aircraft system generated downtime and supply system generated downtime. A preliminary design model to enable the design engineer to optimize operational availability within specified cost restraints is addressed to the aircraft system component of the function.
Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N69-40006*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A PARASITIC LOAD SPEED CONTROL FOR DYNAMIC SPACE POWER SYSTEMS
Hugh Milton Holt (M.S. Thesis – Va. Univ.) Aug. 1969 95 p refs
(NASA-TM-X-61901) Avail: CFSTI CSCL 10A

A method for controlling the speed of a dynamic space power system by a parasitic electric load technique is investigated. A mathematical representation of the power system and speed control is developed. From this model, a linear approximation is utilized to synthesize a compensation network that will produce a specific response in the rotational speed of the power system to a change in electrical load. It is shown that the compensation network can be modified to accommodate a wide range of responses for dynamic power systems. Curves are given that display the response of a model of the control changes in operational load. The model of the control includes the compensation network and analog simulations of a frequency sensor, a parasitic load, and the rotating unit. Finally, problems that are expected in the design of a parasitic load and in the integration of the control with the space power system are discussed.
Author

N69-40040# Royal Aircraft Establishment, Farnborough (England). Space Dept.
ENVIRONMENTAL ASSESSMENT OF THIN SILICON SOLAR CELLS FROM PILOT PRODUCTION
R. L. Crabb and D. Basnett (Ferranti, Ltd.) Jan. 1969 42 p refs Presented at the 7th IEEE Photovoltaic Specialists' Conf., Pasadena, 19–21 Nov. 1968 Prepared jointly with Ferranti Ltd., Chadderton
(RAE-TR-69006) Copyright. Avail: CFSTI

Following the earlier demonstration of the performance capabilities of 4 mil silicon solar cells and the feasibility of using these cells on large flexible arrays of space vehicles, more than a thousand 4 mil cells have been fabricated in pilot production by four routes. The various types of cells which have been evaluated had solderless evaporated titanium-silver contacts in both a conventional and wrap-round configuration, solderless evaporated titanium-silver contacts 'over-plated' with a layer of copper-gold, and solderless plated nickel-copper-gold contacts in a conventional and wrap-round configuration. Both 1 × 2 and 2 × 2 cm, n on p cells have been manufactured from 1 and 10 ohm cm boron doped silicon. In every case, satisfactory production yields have been achieved. The above cells have been subjected to environmental conditions aimed at studying the effects of high ambient humidity on the cell contacts during 'shelf-life' prior to launch and the degradation in performance from electron and proton irradiation encountered during long term spiral transfer orbits to synchronous altitude. Specifically the problem of low energy 'synchronous altitude' proton irradiation of exposed bar and back contacts and the protection afforded by various forms of coatings has been investigated.
Author (ESRO)

N69-40063*# McDonnell-Douglas Astronautics Co., Newport Beach, Calif. Astropower Lab.
DEVELOPMENT OF IMPROVED ZINC ELECTRODES FOR SECONDARY BATTERIES Final Report, Jul. 1968 - Jul. 1969
A. Himy Jul. 1969 206 p
(Contract NAS3-11830)
(NASA-CR-72593; DAC-61001-F) Avail: CFSTI CSCL 10C

A new zinc electrode construction was evaluated, based on an inorganic material mixed with zinc oxide, which acted as a binder when the mix was sintered at 850°C. Zirconia was selected over two other inorganic materials; proportions ranging from 2% to 50% were investigated for physical characteristics and from 5% to 20% for electrical characteristics. PbO was investigated as an additive, besides the usual 2% HgO amalgamation. A total of 20 combinations of construction features were electrically tested on three different cycling regimes. In general, zinc shape retention was improved in varying degrees, reflected in longer cycle life over the regular unsintered zinc oxide electrode. Author

N69-40246*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SOLAR ARRAY SYNTHESIS COMPUTER PROGRAM
A. F. Obenschain and R. Rasmussen (GE, Philadelphia) Sep. 1969 60 p refs Prepared by GE
(Contract NAS5-10158)
(NASA-TM-X-63709; X-716-69-390) Avail: CFSTI CSCL 10B

Solar cell arrays provide the primary energy source for most earth orbiting satellites. The solar cell utilizes the radiative energy from the sun in direct photovoltaic conversion to provide electrical power to the spacecraft. The computer program described will account for all factors, including isolation diode voltage losses, charged particle irradiation, temperature, solar incidence angle and other solar cell degradation factors affecting the power output of solar arrays, and thereby greatly reduce the lenghy and laborious hand calculations now necessary in designing an array or predicting its performance. The program will determine the total power output of solar arrays consisting of up to 25 electrically-parallel panels; each panel may have its own series-parallel solar cell arrangement, temperature versus time profile and sun angle versus time profile. The output of the program is a series of current-voltage (I-5) points representing the total solar array I-5 characteristic at up to 20 times during an orbit. Author

N69-40362*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SECONDARY AEROSPACE BATTERIES AND BATTERY MATERIALS: A BIBLIOGRAPHY
G. Halpert and W. H. Webster, Jr. Aug. 1969 157 p refs
(NASA-TM-X-63707) Avail: CFSTI CSCL 10C

A bibliography on the subject of secondary aerospace battery materials and related physical and electrochemical processes is presented. The scope of this bibliography encompasses subjects ranging from metallurgical processes and inorganic preparations to electrochemical and analytical measurements as applied to these systems. The survey includes technical journal articles published from 1923 through 1968. More than 370 articles and accompanying abstracts were compiled from 40 foreign and domestic journals. Author

N69-40416# Army Electronics Command, Fort Monmouth, N.J.
CHARGING THE SILVER ZINC SECONDARY BATTERY SYSTEM. PART 1: FORMATION CHARACTERISTICS
Martin J. Sulkes Jun. 1969 18 p refs
(Contract DA-1-T-662705-A-053)
(AD-691710; ECOM-3139) Avail: CFSTI CSCL 10/3

Dry uncharged silver-zinc batteries exhibit a reverse voltage as high as 0.8 V/cell after filling with electrolyte. This negative voltage presents a problem with regard to initiating the first charge with chargers that have reverse voltage protection. The voltage-current characteristics of unformed silver-zinc batteries and the individual electrodes were determined. The unformed silver-zinc battery has the potential of 0.7 - 0.8 volts. The unformed battery is capable of supporting only limited currents before the voltage reaches zero volts. Therefore, short circuiting before charge and/or connection to an auxiliary power source will drive the voltage positive in a short time, permitting initiation of charge on a reverse voltage protected charger. If reverse voltage protection is not employed in the charger, the reverse voltage of an unformed battery will not support sufficient currents to damage the charger. Author (TAB)

N69-40422*# CARA Corp., Philadelphia, Pa.
THE RELATION BETWEEN SOLAR CELL FLIGHT PERFORMANCE DATA AND MATERIALS AND MANUFACTURING DATA Quarterly Report
S. R. Pollack 16 Sep. 1969 29 p
(Contract NASw-1732)
(NASA-CR-106355; QR-4) Avail: CFSTI CSCL 10B

This program examines the flight performance data for solar cell power systems in satellites. An attempt is made to relate the differences in performance to the materials and manufacturing factors in the solar cell system. This is done by acquiring data from different flights with similar space environments and comparing the results. Author

N69-40440*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MOTOR-STARTING CHARACTERISTICS OF TWO INDUCTOR ALTERNATORS
Charles S. Corcoran, David S. Repas, and Martin E. Valgora Washington Oct. 1969 13 p refs
(NASA-TM-X-1912) Avail: CFSTI CSCL 10B

Two inductor alternators were started as induction motors. One machine had a 5.2-inch (13.2-cm) diameter rotor with amortisseur windings and laminated pole tips; the other had a 7.38-inch (18.7-cm) diameter rotor with solid poles. Armature current, field voltage, and rotational speed were measured as functions of time. Torque was computed and is presented as a function of speed. The machine starting performance is compared to the requirements of a typical Brayton cycle generating system. Author

N69-40470# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
THERMIONIC CONVERTERS: SIRENE IRRADIATION DEVICE [DISPOSITIF D'EXPERIMENTATION EN PILE DES CONVERTISSEURS THERMIONIQUES SIRENE]
Jean Bliaux, Jean-Paul Durand, and Gilbert Lazare-Chopard Aug. 1969 23 p refs In FRENCH; ENGLISH summary Presented at the Meeting of the EURATOM Working Group on Irradiation Devices, Ispra, Italy, 21-22 May 1969
(CEA-R-3867) Avail: CFSTI

The irradiation device described in this report was built for in-pile life tests of 100 We Sirene converters. The nuclear converter was located in a sealed vacuum chamber, which was plugged at the lower end of a coaxial tubing acting as electrical leads. The output power was available on a variable resistive load on the bank of the reactor pool. Thermal, electrical and neutronic parameters of the converter were recorded. Since 1967, two permanent devices have been used for five experiments in the swimming pool Triton (CEN-FAR) and the results are presented. Author (ESRO)

N69-40532*# Texas Technological Coll., Lubbock. Dept. of Geosciences.
MARTIAN ENVIRONMENTAL EFFECTS ON SOLAR CELLS AND SOLAR CELL COVER GLASSES Quarterly Report
F. Alton Wade 15 Oct. 1969 14 p refs Prepared for JPL

(Contracts NAS7-100; JPL-952582)
(NASA-CR-106385; TTU-3301; QR-1) Avail: CFSTI CSCL 10B

The possibility of dust storms on Mars is recognized as is the possibility of detrimental effects of dust storms to any solar cell array placed at or near the surface of Mars. Solar cells will be subjected to dust storms in wind tunnels where simulated Martian environmental conditions prevail. The electrical performance of the solar cells will be tested before and after each test and the damage to the cells will be assessed. As no tests have been completed, no conclusions or recommendations are presented. Author

N69-40574# Commissariat à l'Energie Atomique, Chusclan (France). Centre de Production de Plutonium.

USE OF A THIN-FILM EVAPORATOR FOR BITUMEN COATING OF RADIOACTIVE CONCENTRATES [UTILISATION D'UN EVAPORATEUR A COUCHE MINCE POUR L'ENROBAGE PAR LE BITUME DE CONCENTRATS RADIOACTIFS]

Guy Lefillatre, Jean Rodier, Raoul Hullo, Yvonne Cudel, and Lucienne Rodi Jul. 1969 32 p refs In FRENCH; ENGLISH summary
(CEA-R-3742) Avail: CFSTI

Following the development in the laboratory of a process for coating evaporation concentrates with bitumen, a technological study has been undertaken. The report describes a pilot installation for the bitumen coating of concentrates, which uses a thin-film evaporator Luwa L 150. A first inactive series of tests was designed to determine the maximum and optimum capacities of the evaporator by varying the amounts of bitumen and concentrate, the rotor speed and the thermo-fluid temperature. Two rotors were tested, one of conventional type, the other a model especially designed for high viscosity products. The maximum capacity of evaporation of the apparatus is 72 kg/h at a heating temperature of 221°C. During normal operation, the evaporator can produce 50 kg/h of coated product containing 55 to 60 per cent of bitumen (Mexphalte 40/50), the water content of the product remaining under 0.5 per cent. A second series of tests will shortly be carried out on this pilot installation using, in particular, bitumenous emulsions containing mainly Mexphalte 40/50 and 80/100. Author (ESRO)

N69-40586# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

ONE VOLT ISOTOPIC MICROGENERATORS [LES MICROGENERATEURS RADIOISOTOPIQUES 1 VOLT]

Robert Bomal, Bernard Devin, and Philippe Delaquaize Jun. 1969 75 p refs In FRENCH; ENGLISH summary
(CEA-R-3834) Avail: CFSTI

Various configurations for electrical isotopic generators in the milliwatt range are investigated; these generators are not of the classical thermoelectric type. The four following energy conversion methods are examined: (a) Thermionic, (b) Thermophotovoltaic, (c) Radiovoltaic and (d) Wired thermoelectric. Calculations were conducted with the aim of obtaining directly 1 volt output voltage and not with the best energy conversion efficiency. High temperature ^{238}Pu sources (T above 1000°K) were isolated by multilayer thermal insulation materials of the Moly/Alumina type. Optimised application is given for (a) and (b) above. The thermionic method is interesting due to its compactness and the wired-thermoelectric one is cheap, simple and rugged. Both methods do not give output voltages far above 1 volt. The other two methods can be designed for multivolt application. The radiovoltaic one is 1 per cent efficient but irradiation defects in the semiconductor induced by high energy radiations can strongly limit the lifetime of the generator. Isotope source technology is the determining factor for these microgenerators. Author (ESRO)

N69-40723# Leesona Corp., Great Neck, N.Y. Leesona Moos Labs.

DEVELOPMENT OF ZINC/AIR 24 VOLT, 20 AMPERE-HOUR STANDARD LINE BATTERY SYSTEM Final Report, 8 Mar. - 29 Nov. 1968

Peter Noorily Ft. Monmouth, N.J. ECOM Jun. 1969 51 p
(Contract DAAB07-68-C-0265)
(AD-690856; ECOM-0265-F) Avail: CFSTI CSCL 10/3

This report describes the design and development of the 20 ampere-hour Standard Line Battery system to be utilized in military communication applications. The primary objective of this program was the development of a reliable zinc/air battery system which will include an adequate water reservoir to permit long operating life. In addition, the battery design required light weight and high strength, with a capability of being easily recharged. The battery system was also to have high energy density and be operational over a wide temperature range. Author (TAB)

N69-40742*# Texas Instruments, Inc., Attleboro, Mass. Research and Development Labs.

HEAT STERILIZABLE AND IMPACT RESISTANT Ni-Cd BATTERY DEVELOPMENT Quarterly Report, 1 Apr. - 30 Jun. 1969

P. V. Popat, R. L. Crawford, J. M. Gondusky, and E. J. Rubin 30 Jun. 1969 104 p Prepared for JPL
(Contracts NAS7-100; JPL-951972)
(NASA-CR-106364) Avail: CFSTI CSCL 10C

Since the engineering capability of satisfactory heat-sterilizable cells has been proven as demonstrated by extensive post-sterilization cycling at 100% d.o.d. of sealed 4AH and 25AH prismatic and 25AH cylindrical cells without significant performance change, further electrochemical investigations were directed towards better understanding of the behavior of sterilized positive and negative electrodes. Emphasis was placed on open circuit potential decay rates of the positive plate as a function of sterilization time. The 4AH factorial cells after sterilization have completed 207 deep cycles while 18 plate cells have completed 150 deep cycles with stable performance. These cells will be further characterized under various conditions of interest to J.P.L. The development of a crimp polymeric seal for heat-sterilizable and impact resistant Ni-Cd space cells was continued. Author

N69-40757*# Gulf General Atomic, San Diego, Calif.

RADIATION EFFECTS IN SILICON SOLAR CELLS Quarterly Report

R. A. Berger, H. Horiye, J. A. Naber, and B. C. Passenheim 10 Oct. 1969 24 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952387; Gulf Proj. 6105)
(NASA-CR-106368; GA-9756) Avail: CFSTI CSCL 10B

The electron spin resonance technique has been used to study the mechanisms for the production and annealing of the divacancy (Si-G7) in lithium-diffused n-type silicon irradiated with 30-MeV electrons. The results indicate that lithium does affect divacancy production and annealing in a manner similar to the manner in which lithium affects the production and annealing of the oxygen-vacancy (Si-B1) center. Measurements of the lithium concentrations present in a lithium-diffused n-type silicon sample based on neutron activation analysis indicate that more lithium is present than as determined by resistivity measurements. Author

N69-40775*# Boeing Co., Seattle, Wash. Aerospace Group.

INVESTIGATION INTO THE MECHANISM OF DEGRADATION OF SOLAR CELLS WITH SILVER-TITANIUM CONTACTS Quarterly Progress Report, 1 Apr. - 30 Jun. 1969

30 Jun. 1969 46 p refs
(Contract NASw-1859)
(NASA-CR-106405; D2-126194-1; QPR-1) Avail: CFSTI CSCL 10B

Degradation has been observed under controlled laboratory conditions in solar cells exposed to electrolytic solutions and to high humidity. Important findings were: (1) Potentiostatic and real-potential measurements confirmed that the degradation is electrochemical. (2) Rest potential determines whether a solar cell

under electrolyte will or will not degrade in the manner that it degrades in a humid atmosphere. (3) Mass spectroscopy shows the presence of several contaminants which are important in other corrosion reactions. These include fluorides, copper, and water. (4) X-ray diffraction studies show the effect of sintering, i.e., a partially crystalline structure on the silver surface and an unidentified compound at the silver – titanium interface. Two degradation mechanisms are being studied in detail. One relates the corrosion to capillary movement of moisture through the silver to react with titanium. The second postulates the transport of atomic hydrogen to an impervious boundary where $2H^{\circ} \rightarrow H_2$ forms a blister. Author

N69-40787*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONCEPTUAL DESIGN AND STRUCTURAL MODEL OF A 560-WATT THIN-FILM SOLAR-CELL ARRAY
Francis J. Stenger. Washington Oct. 1969. 14 p refs
(NASA-TM-X-1913) Avail: CFSTI CSCL 10B

A structural model of a cadmium sulfide thin-film solar-cell array was constructed with a deployment structure weight of 0.12 lb/sq ft (0.59 kg/m^2) of panel area and a projected power output of from 15.5 to 19.4 W/lb (34.2 to 42.7 W/kg) using available CdS solar cells. The rollout, nonretractable array used a 40-ft (12.2-m) long storable boom as the basic structural element. The boom stiffness was tested using two simple mechanical suspensions. Author

N69-40859# Gulton Industries, Inc., Metuchen, N.J. Research and Development Div.
ACCEPTANCE TESTING OF VENTED, RECHARGEABLE SILVER CADMIUM CELLS Final Report, Sep. 1968 - Jan. 1969
S. Charlip and H. N. Seiger. Aug. 1969. 38 p
(Contract DA-36-039-AMC-03359(E))
(AD-691355; ECOM-03359-F) Avail: CFSTI CSCL 10/3

The report gives the capacities obtained from acceptance testing of four silver-cadmium cells under the following conditions: room temperature capacity and seven day storage; cold temperature (-40F); and high temperature (+160F) seven day storage. Two cells failed to meet the minimum capacity requirements after the high temperature storage. All other test results fell within the limits of the specification and contract. Author (TAB)

N69-40883# Arizona Univ., Tucson. Engineering Experiment Station.
THE EFFECT OF SIMULATED FISSION PRODUCTS IN THE INTER-ELECTRODE SPACING OF A THERMIONIC DIODE Annual Report, 1 Nov. 1967 - 31 Oct. 1968
Monte V. Davis. Oct. 1968. 27 p refs
(Contract Nonr-2173(13))
(AD-686668; AR-4) Avail: CFSTI CSCL 10/2

The development of experimental diode systems is discussed. Description of requirements and problems associated with dual vapor (barium and cesium) at temperatures greater than 750C are presented. The density of ions trapped in the double emitter sheath is calculated analytically; and the results displayed. A numerical calculation of the effect of an array of point dipoles on a surface work function is compared with an analytical result using smeared charge sheet potentials. Author (TAB)

N69-40923*# Tyco Labs., Inc., Waltham, Mass.
DEVELOPMENT OF UNIFORM AND PREDICTABLE BATTERY MATERIALS FOR NICKEL-CADMIUM AEROSPACE CELLS Quarterly Report, 8 Feb. - 7 May 1969
7 May 1969. 27 p
(Contract-NAS5-11561)
(NASA-CR-106451; QR-4) Avail: CFSTI CSCL 10C

This report describes the preparation of nickel-cadmium battery plaques by coating a 20-mesh nickel screen with a slurry of nickel powder in a methyl cellulose solution. There were 23 preparations made in a semicontinuous process. The following variables were studied: nickel powder type, ratio of nickel powder to methyl cellulose in the slurry, doctor blade setting, pulling speed, and screen thickness. The plaques ranged in thickness from 0.014 to 0.031 in., and the preferred slurry viscosity was close to 1×10^5 cps. Selected plaques were examined for uniformity across the width of the screen and along the direction of pulling. Very good uniformity was obtained across the width, e.g., less than 0.2% variation in porosity and no variation of surface area within the accuracy of the measurement. A 0.5% variation in porosity was observed between the first and last plaques of a single pulling operation. Author

N69-40927*# Electro-Optical Systems, Inc., Pasadena, Calif.
RESEARCH AND DEVELOPMENT OF ELECTROFORMED ALUMINUM SOLAR CELL CONTACTS AND INTERCONNECTS Periodic Progress Report, 5 Jun. - 4 Oct. 1969
Kenneth Lui. 21 Oct. 1969. 29 p ref. Prepared for JPL
(Contract NAS7-100)
(NASA-CR-106383; EOS-4039-Q-1) Avail: CFSTI CSCL 10B

Work is reported on aluminum-contact solar cells using the aluminum electroforming technology. The results of studies in photoresist masking, optimization of the plating process, and the effects of sintering are reported. The production of electroformed aluminum-contact cells with greater than 10% AMO efficiency is reported, using SiO antireflection coating and no cover slips. Author

N69-40929*# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
ROLLUP SUBSOLAR ARRAY Quarterly Technical Report, 1 Jun. - 31 Aug. 1969
15 Sep. 1969. 228 p refs. Prepared for JPL
(Contracts NAS7-100; JPL-952314)
(NASA-CR-106367; GE-SSO-69SD4351; QR-2) Avail: CFSTI CSCL 10B

Results of the activities performed to design and develop the technology of a 30 watt per pound rollup solar array are reported. The major effort was devoted to the detailed design of component parts. Each component is described, and the associated performance analysis in support of the design is presented. System test planning has been started and the design requirements for the supporting equipment are established along with preliminary implementation concepts. Author

N69-40936*# Hughes Aircraft Co., Culver City, Calif.
ENGINEERING STUDY OF ELEVATED TEMPERATURE SOLAR CELL PANEL FABRICATION TECHNIQUES Summary Report, 1 Jun. 1968 - 15 May 1969
S. Schwartz and D. B. Cohen. Sep. 1969. 111 p refs
(Contract NAS2-4878)
(NASA-CR-73352) Avail: CFSTI CSCL 10B

This report describes an engineering study made to determine materials and fabrication techniques to be used in production of elevated temperature resistant solar cell panels. Panels meeting operational requirements from 173°K to 483°K were produced. The solar cell panel substrates were made using aluminum honeycomb and epoxy-novolac-fiberglass facings. The solar cell coverslides were bonded using a silicone adhesive, and another silicone adhesive was used to bond the cells to the substrate. Two methods of module fabrication were investigated: high temperature solder in conjunction with copper screen interconnects and ultrasonic diffusion bonding using aluminum foil interconnects. A series of small panels were first fabricated to establish optimum materials and processes and then a large (~ 1 ft. sq, 360 cell) panel was made for vibration, acceleration, thermal-vacuum tests, and also for evaluation of performance at intensities from 1 to 25 suns. In addition to panel fabrication and evaluation, an estimate was made of the costs to produce a full size Pioneer type spacecraft solar panel. Author

N69-40947*# American Univ., Washington, D.C.
RESEARCH INTO FUNDAMENTAL PHENOMENA ASSOCIATED WITH SPACECRAFT: ELECTROCHEMICAL DEVICES AND CALORIMETRY OF NICKEL-CADMIUM CELLS Progress Report, 1 Oct. 1968 - 31 Aug. 1969
R. T. Foley and G. D. Mitchell. 31 Aug. 1969. 23 p.
(Contract NAS5-10105)
(NASA-CR-106392; PR-10) Avail: CFSTI CSCL 10C

The objectives of this project are to train electrochemists in the area of battery research and to collect electrochemical and thermodynamic data. The specific experimental work deals with the calorimetry of Ni-Cd cells. In the final reporting period the work was designed to answer questions dealing with heat transfer in the 20 ampere-hour cell and the precision of the data previously reported. Experiments with a nickel-cadmium cell specially fabricated with an internal calibration heater indicated a higher signal (100-150 mv/watt) but a longer response time (30-50 minutes) than previous experiments with a resistance wire heater mounted under the cell in the calorimeter. The data on the 6 ampere-hour cell and the 20 ampere-hour cell were evaluated statistically. It was established that the data from the 20 ampere-hour cell has a confidence level of 89% and a 90.5% probability that each measurement will be between ±2 standard error. In an experiment in which the mean heat was -1.035 watts the standard error was 0.068 watts. Author

N69-40952*# Textron Electronics, Inc., Sylmar, Calif. Heliotek Div.
DEVELOPMENT OF AN INTEGRATED LIGHTWEIGHT FLEXIBLE SILICON SOLAR CELL ARRAY Quarterly Technical Report, 1 Jul. - 1 Oct. 1969
E. L. Ralph, E. F. Zimmerman, and P. M. Stella. Oct. 1969. 61 p. Prepared for JPL
(Contracts NAS7-100; JPL-952560)
(NASA-CR-106379; QTR-1) Avail: CFSTI CSCL 10B

The study is to provide design data that will help in the development of an integrated lightweight flexible silicon solar cell array significantly lighter and less expensive than arrays presently being designed. Included in this report are solar cell cost effectiveness comparison, a preliminary analysis of a continuous process solar cell ultra-thin cover installation process, a detailed analysis of solar cell interconnect stresses and an analysis of a ribbon substrate with associated test data. Author

N69-40977*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OBSERVATIONS OF HOTSPOTS AND METALLIC DEPOSITS IN CdS THIN SOLAR CELLS
Michael P. Godlewski, John M. Bozek, and Larry R. Scudder. 10 Oct. 1969. 17 p. refs
(NASA-TM-X-52697) Avail: CFSTI CSCL 10B

The output of thin film CdS solar cells degraded while illuminated at open circuit and while unilluminated at forward bias. Hotspots appeared at grid wires. During the illuminated tests copper nodules formed on the surface and within the cell. Surface nodules coincided with hotspots only when they contacted grid wires; subsurface nodules were found only under grid wires and coincided with hot spots. In the unilluminated tests copper filaments were found under grid wires at hotspot locations and extended through the cell to the substrate. Author

N69-41170*# Exotech, Inc., Washington, D.C.
SOLAR CELL PERFORMANCE MATHEMATICAL MODEL Quarterly Report, 1 Jun.-31 Aug. 1969
M. J. Barrett. 15 Sep. 1969. 33 p. refs. Prepared for JPL
(Contract NAS7-100)
(NASA-CR-106377; QR-1) Avail: CFSTI CSCL 10B

Results of the first three months of an effort to prepare a computer program for silicon solar cell performance in the space environment are reported. The previously completed mathematical model has been reviewed in the light of current research activity and minor improvements to the model are suggested. An analysis of alternative techniques is provided. Author

N69-41189*# Radio Corp. of America, Princeton, N.J.
STUDY TO DETERMINE AND IMPROVE DESIGN FOR LITHIUM-DOPED SOLAR CELLS Quarterly Report, 24 Jun. - 30 Sep. 1969
10 Oct. 1969. 53 p. refs. Prepared for JPL
(Contract NAS7-100)
(NASA-CR-106378; AED-R-3497; QR-1) Avail: CFSTI CSCL 10B

Technical progress during this reporting period includes preliminary Hall and resistivity measurements which indicate that as the lithium concentration in the Hall samples decreases, the curve of carrier-removal rate vs temperature appears to shift along the temperature axis to lower temperatures while carrier removal at higher bombardment temperatures (T_B = 140° K - 297° K) appears to decrease. Recovery time constants of Hall samples allowed to anneal at room temperature were longrer at lower lithium onconcentrations, this being in agreement with previous results obtained for minority-carrier properties in solar cells. Further evidence was obtained for the dissociation of the LiV defect and the formation of complexes between lithium and acceptor defects during the annealing of irradiated Hall samples at 297° K. Measurements of minority-carrier diffusion length versus temperature on two lithium solar cells made from antimony-doped, oxygen-rich silicon and irradiated to 3×10^{15} e/cm^2 at 77°K, indicate the generation of a defect at an energy level of approximately E_C - 0.16 eV. During a six-hour, 373°K anneal, both cells displayed significant lifetime recovery with approximately first-order kinetics, the kinetics observed previously in annealing of solar cells containing lithium. Author

N69-41240*# TRW Systems Group, Redondo Beach, Calif.
STUDY AND DETERMINATION OF AN OPTIMUM DESIGN FOR SPACE UTILIZED LITHIUM DOPED SOLAR CELLS Quarterly Report
R. G. Downing. 15 Oct. 1969. 15 p. Prepared for JPL
(Contracts NAS7-100; JPL-952554)
(NASA-CR-106483; QR-1; TRW-13154-6003-R0-00) Avail: CFSTI CSCL 10B

Efforts were directed at solution of the theoretical problems associated with use of lithium doped silicon solar cells. Studies on carrier removal during electron irradiation were extended to lithium doping levels of less than 10^{16} atoms/cm^3. In this range carrier removal becomes a two step process. The first step is carrier removal during irradiation and the second a time dependent removal after irradiation. The two steps appear to be respectively associated with the processes of damage and recovery in lithium doped cells. The removal rate during irradiation appears to be a function of fluence and lithium concentration. The quantity of carriers removed during the time dependent phase is at least twice that removed during the irradiation. No new defects are detected after the completion of the time dependent removal. Capacitance studies of lithium doped quartz crucible cells indicate that considerably less lithium is consumed during irradiation compared to a float zone cell. The recovery period, however, is similar to the float zone cell in this respect. Capacitance studies as a function of temperature were instituted and appear to have potential for future investigations. Author

N69-41265# Stanford Linear Accelerator Center, Calif.
LARGE DC MAGNET POWER SUPPLIES AT SLAC
Martin M. Berndt. Mar. 1969. 5 p. Sponsored by AEC. Presented at 1969 Natl. Particle Accelerator Conf., Washington, 5 - 7 Mar. 1969
(PB-183835; SLAC-Pub-565) Avail: CFSTI CSCL 10B

Currently a total of six dc magnet power supplies, ranging in size from 1.6 MW to 6.0 MW are in operation at the Stanford Linear Accelerator Center (SLAC). Five of these supplies are static

converters, using step-down transformers and thyristors, while the sixth one is a two-unit motorgenerator set. Certain design criteria have evolved, dictated by specific needs at SLAC and by operating experience obtained over the three-year period during which this equipment was installed. Primary power distribution is at 12.47 kV. Vacuum switches in place of circuit breakers incorporating special protective equipment to prevent complications have been successfully used to do the frequent switching required by the loads.
Author (USGRDR)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology

N69-40016*# Texas Womens Univ. Research Inst., Denton.
EFFECTS OF PROGRAMMED EXERCISE ON SKELETAL DENSITY AND CALCIUM BALANCE DURING HORIZONTAL BED REST OF HEALTHY ADULT HUMAN MALES
[1969] 214 p refs
(Contract NAS9-8246)
(NASA-CR-101958) Avail: CFSTI CSCL 06D

Regular exercise effects on the human skeleton and calcium, phosphorus, nitrogen, creatinine and creatine content during prolonged bed rest were examined. Statistical evaluation of various body function data showed that humans who exercised regularly excreted less calcium and phosphorus than those that did not exercise; bone density values supported this finding. Prolonged exercise-free bed rest also increased the nitrogen balance in the body. All subjects exhibited a significant increase ($P > 0.001$) of urinary creatinine and creatine in comparison with the pre-bed rest period, whether exercise was used or not. The pattern of a definite circadian rhythm was observed in the urinary calcium and nitrogen excretion during bed rest; this pattern was only slightly altered during a bed rest-exercise regime. G.G.

N69-40260# Joint Publications Research Service, Washington, D.C.
SPACE BIOLOGY AND MEDICINE
O. G. Gazenko. *In its* USSR Achievements in Space Res. (1st Decade in Space, 1957 - 1967) 24 Jan. 1969 p 365 - 422 refs (See N69-40251 24-13)
Avail: CFSTI

Space biology is defined as an independent branch of biology concerned with three principal problems: (1) behavior of terrestrial organism in space (exophysiology), (2) existence, propagation, peculiarities, and evolution of living matter in the universe (exobiology); and (3) biological principles and methods for devising an artificial habitable medium in spacecraft (bioengineering, ecology of closed systems). The objectives of space medicine are listed, and exophysiology, ecology of closed systems, exobiology, some medical problems in supporting manned spaceflight, and biological research on rockets and spacecraft are discussed. It is concluded that improvements in space medicine and flight safety will make possible more complex flights of greater duration. F.O.S.

N69-40264 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEUTRONS IN RADIOBIOLOGICAL EXPERIMENTS
B. M. Isaev et al. Nov. 1968 296 p refs Transl. into ENGLISH of the book "Neitrony v Radiobiologicheskom Eksperimente" Moscow, 1967 p 1 - 292
(AD-691153; FTD-MT-24-258-68) Avail: CFSTI

The methodology of radio biological experiments using radioactive isotopes as neutron sources is discussed as are accelerators and reactors. The physical mechanisms of neutron interaction with biological objects, methods of measuring and calculating the absorbed doses, and are considered quality of irradiation, determined by its biological effectiveness is studied in detail. Measuring and calculating the distribution of absorbed doses according to line at energy loss is discussed. These parameters characterizing the interaction of radiation with the material must be considered during the formulation of qualitative radiobiological investigations.
Author (TAB)

N69-40324*# National Aeronautics and Space Administration, Washington, D.C.
CONCENTRATION OF MATTER AND ACTION OF ENZYMES IN COACERVATES
T. N. Yevreinova. Oct. 1969 223 p refs Transl. into ENGLISH of the book "Kontsentrirovaniye Veshchestv i Deystviye Fermentov v Koatservatkh" Moscow, Nauka Press, 1966 p 3 - 186
(NASA-TT-F-525) Avail: CFSTI CSCL 06C

The book brings together published data and the author's own experimental findings on coacervate systems consisting of compounds formed biogenically: proteins, nucleic acids, enzymes, carbohydrates, and other biopolymers and low molecular compounds included in the composition of living organisms. Most attention is given to the main property of coacervation, i.e., the concentration of compounds in individua coacervate drops both during their formation and during their absorption of substances, including enzymes, from the surrounding solution. It is shown that coacervate drops constitute very suitable models which can be used to elucidate and reproduce many of the phenomena characteristic of protoplasm, and to approach the solution of the most important problem in biology, the artifical synthesis of living matter. Author

N69-40490# Naval Submarine Medical Center, Groton, Conn.
THE EFFECT ON PULMONARY FUNCTIONS OF RAPID COMPRESSION IN SATURATION EXCURSION DIVES TO 1000 FEET
James H. Dougherty, Jr. and Karl E. Schaefer. 15 Mar. 1969 15 p refs
(AD-691368; SMRL-573) Avail: CFSTI CSCL 6/19

Four subjects were rapidly compressed at a rate of 2 - 3.5 feet per minute to 600 and 800-foot depths. They remained at saturation depths for 35 and 36 hours and carried out excursion dives lasting three hours to 800 and 1,000 feet, respectively. Maximal Expiratory Flow Rate (MEFR) and Maximal Inspiratory Flow Rate (MIFR) measured with a Wedge spirometer at 200-foot increments during rapid compression showed a linear decrease with the increase in pressure. During the 35-36 hour saturation period, MEFR increased 33-35%; and MIFR rose 16-30% from the initial values obtained at saturation depths. The recovery of MEFR was not limited to peak flow rates, but also pronounced at the MEFR measured at 50% of vital capacity, indicating that the recovery was independent of musclar effort. Airway collapse during rapid compression and reopening during the subsequent saturation period is proposed as the most likely explanation for the observed changes. Vital capacity decreased during the compression and decompression period and showed a tendency to increase during the saturation period. Evidence of air-trapping was seen in flow-volume loops measured at depth. Author (TAB)

N69-40550# Oregon State Univ., Corvallis. Dept. of Mathematics.
VISUAL ILLUSIONS OF ANGLE AS AN APPLICATION OF LIE TRANSFORMATION GROUPS
William C. Hoffman (Oakland Univ.) 1 Jul. 1969 35 p refs
(Contract N00014-67-A-0369)
(AD-691840) Avail: CFSTI CSCL 6/16

Visual illusions of angle are explained in terms of a calculus of visual constancies laid down earlier as misapplication of constancy. The rule is as follows: Identify the curves appearing in the visual illusion as orbits of the appropriate visual constancy (or constancies). Keep the Lie derivative that corresponds to the constancy whose orbit(s) appear distorted in the illusion, but replace the other by the Lie derivative orthogonal to it. Form a linear combination of the resulting two Lie derivatives, weighting the one

that is kept the more strongly. This linear combination will generate the distorted portion of the illusion. TAB

N69-40603*# California Univ., Los Angeles. Space Biology Lab.
THE DESIGN AND CONSTRUCTION OF A THERMAL SYSTEM TO MEASURE SMALL TEMPERATURE CHANGES IN THE BRAIN
James G. McElligott 1969 6 p refs Presented at the 7th Temp. Meas. Soc. Conf., Hawthorne, Calif., 21 -22 Apr. 1969
(Grant NGR-05-007-195)
(NASA-CR-106386) Avail: CFSTI CSCL 06P

A system is described by which small localized temperature changes can be measured in the brain. The system includes three types of probes: a thermistor - electrode probe, heated-thermistor probe, and a differential-thermistor probe. An ac compensating ratio bridge when used with a low noise/high gain amplifier linearizes the response of the thermistor over the temperature range used. It is possible to detect temperature changes as small as .0002°C with this system. Author

N69-40609# Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.
COMPARISON OF SEVEN SYSTEMS FOR AIR CONDUCTION AUDIOMETRY FROM 8-20 KC/S
Cecil K. Myers and J. Donald Harris 18 Feb. 1969 19 p refs
(AD-6911367; SMRL-567) Avail: CFSTI CSCL 6/12

Seven equipment systems were assembled to study human auditory acuity from 8-20 kilocycles/sec. Twenty-eight ears were examined. Two loudspeakers and two earphones were utilized, two types of stimulus (pure tones and narrow bands of noise, and two psychometric methods (Limits and Adjustments)). All systems were capable of providing usably reliable thresholds throughout the whole frequency range. When objectively calibrated, several systems (those involving loudspeakers, as well as those involving earphones), yielded quite comparable reference threshold sound pressure levels as inferred at the eardrum. A slight preference was expressed for a system, the method of using Bekesy threshold-tracking, with a changing-frequency noise band 300 c/s in width, and for a discrete-tone system which uses the Method of Constants. Author (TAB)

N69-40621# Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.
EFFECT ON VISION OF REPEATED EXPOSURE TO CARBON DIOXIDE Interim Report
Donald O. Weitzman, Jo Ann S. Kinney, and S. M. Luria 14 Feb. 1969 13 p refs
(AD-691402; SMRL-566) Avail: CFSTI CSCL 6/16

The visual effects of repeated exposure to CO2 at levels commonly regarded as innocuous were investigated. Exposure to CO2 varied cyclically from .03 (air) to 3.0%, at 1 atmosphere pressure, every 24 hours for a period of 6 days. A battery of visual tests was administered during this period and in control periods both before and after the CO2 exposure. Among the various tests, night vision sensitivity and color sensitivity for green were the only ones which repeatedly detected impairment of efficiency during the period of exposure. All other visual functions remained normal. Author (TAB)

N69-40649# School of Aerospace Medicine, Brooks AFB, Tex. Radiobiology Div.
RADIOPROTECTION OF PRIMATES WITH 2-(1-DECYLAMINO, ETHANETHIOSULFURIC ACID IN DIMETHYL SULFOXIDE Final Report, May - Oct. 1968
Horace E. Hamilton, George S. Melville, Jr., and Emmett J. Stork Dec. 1968 18 p refs
(AD-691409; SAM-TR-68-137) Avail: CFSTI CSCL 6/15

Significant radioprotection of primates has been achieved by administering 2-(1-decylamino) ethanethiosulfuric acid, dissolved in dimethyl sulfoxide, intravenously to Macaca mulatta. Administered prior to whole body X-irradiation by a dose of 850 roentgens, this compound has resulted in fifty per cent survival, as compared to zero per cent survival of the placebo treated primates irradiated under identical conditions. Clinical chemistry and hematologic data were obtained preirradiation and on days one, three, and seven postirradiation for three groups of primates; protected and irradiated placebo treated and irradiated, and protected but sham-irradiated. Histopathology examinations were performed on the radiation non-survivors of both the protected and placebo treated animals, and on sacrificed drug controls and radiation survivors. Hematologic data, in the form of higher WBC and platelet values, provided evidence of protection of the lymphoid system. Author (TAB)

N69-40762# Association Francaise pour l'Etude et le Développement des Applications de l'Energie Solaire, Paris.
USE OF SOLAR ENERGY FOR MASS CULTURE OF ALGAE [L'UTILISATION DE L'ENERGIE SOLAIRE PAR LES CULTURES ACCELEREES D'ALGUES]
1969 53 p refs In FRENCH Proc. of a Meeting of the Soc. Franc. des Thermiciens, Paris, 13 Feb. 1969
Avail: CFSTI

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1. BIOLOGICAL PROBLEMS IN CULTURE OF ALGAE A. Moyse (Paris Univ.) 10 p (See N69-40763 24-04)
2. FOREIGN EXPERIMENTS FOR GROWING GREEN ALGAE G. Clément (Inst. Franc. du Pétrole) 12 p refs (See N69-40764 24-04)
3. FRENCH EXPERIMENTS: CULTURE OF SPIRULINE OR BLUE ALGAE H. van Landeghem 13 p (See N69-40765 24-04)
4. VALUE OF THE CROPS: QUANTITY, QUALITY, AND COST PRICE C. Meyer (Inst. Franc. du Pétrole) 6 p (See N69-40766 24-04)

N69-40763# Paris Univ., Orsay (France).
BIOLOGICAL PROBLEMS IN CULTURE OF ALGAE [LES PROBLEMES BIOLOGIQUES DES CULTURES D'ALGUES]
Alexis Moyse *In* Assoc. Franc. Etude et Dévelop. Appl. Energie Solaire Use of Solar Energy for Mass Culture of Algae 1969 10 p In FRENCH (See N69-40762 24-04)
Avail: CFSTI

The development and growth of chlorella are analyzed and it is shown that the growth curve is dependent on the medium in which the algae are grown. The importance of light in their development is stressed and the efficiency of the photosynthesis discussed. ESRO

N69-40764# Institut Francais du Pétrole, Paris (France).
FOREIGN EXPERIMENTS FOR GROWING GREEN ALGAE [LES REALISATIONS ETRANGERES: LES CULTURES D'ALGUES VERTES]
Geneviève Clément *In* Assoc. Franc. Etude et Dévelop. Appl. Energie Solaire Use of Solar Energy for Mass Culture of Algae 1969 12 p refs In FRENCH (See N69-40762 24-04)
Avail: CFSTI

Experimental work carried out at the Massachusetts Institute of Technology, in California, Japan, Czechoslovakia, Germany and Bulgaria for growing chlorella and scenedesmus are reviewed. ESRO

N69-40765# Institut Francais du Petrole, Paris (France).
FRENCH EXPERIMENTS: CULTURE OF SPIRULINE OR BLUE ALGAE [LES REALISATIONS FRANCAISES: LA CULTURE DE LA SPIRULINE, ALGUE BLEUE]
H. van Landeghem *In* Assoc. Franc. Etude et Dévelop. Appl. Energie Solaire Use of Solar Energy for Mass Culture of Algae 1969 13 p In FRENCH (See N69-40762 24-04)
Avail: CFSTI

Spiruline, an alga brought from the Chad region where it has been incorporated in the native diet for many years, has been test-grown in France and Mexico. The culture techniques are described and the results discussed. ESRO

N69-40766# Institut Francais du Pétrole, Paris (France).
VALUE OF THE CROPS: QUANTITY, QUALITY, AND COST PRICE [LA VALEUR DES RECOLTES: QUANTITE, QUALITE, PRIX DE REVIENT]
C. Meyer. *In* Assoc. Franc. Etude et Dévelop. Appl. Energie Solaire Use of Solar Energy for Mass Culture of Algae 1969 15 p In FRENCH (See N69-40762 24-04)
Avail: CFSTI

The nutritional value and protein content of spirulines or blue algae are discussed and the cost of growing them artificially is estimated. ESRO

N69-40779*# Northrop Corporate Labs., Hawthorne, Calif.
DEVELOPMENT OF SUPPORT AND RESTRAINT TECHNOLOGY
W. A. Robbins, G. L. Potter, and C. F. Lombard. Wright-Patterson AFB, Ohio AMRL Apr. 1969 96 p refs Supported in part by NASA
(Contract F33615-67-C-1651)
(NASA-CR-106384; AMRL-TR-68-136) Avail: CFSTI CSCL 06C

Guinea pigs were exposed to backward and forward facing ($-G_x$) and tail first ($-G_z$) impact accelerations in two types of support and restraint systems at entrance velocities of 40, 60, and 80 ft/sec. After exploratory experiments to determine the approximate 50% lethal G level (LD50), estimates of G levels for 40 and 60% mortality were made and 20 guinea pigs were exposed at each level. This was accomplished for each orientation at each velocity in each of the two systems. Using probit analysis, the refined LD50 G level was calculated and the results tabulated for comparison of the two systems for survival potential. Regarding protection, the system employing the isovolumetric principle was markedly superior in $-G_x$ impacts, slightly superior in G_x impacts, and approximately equal in the $-G_z$ orientation. Protection of the cardiovascular system by the isovolumetric system was markedly superior in $-G_x$, $-G_z$ impacts, but only slightly better in G_x impacts. Comparison of the two thoracic-abdominal systems was made possible by the concomitant use of a previously developed support and restraint system for the head. Author

N69-40816# Joint Publications Research Service, Washington, D.C.
GENERALIZATION OF VISUAL STIMULI AS AN EXAMPLE OF SOLUTION OF ABSTRACT PROBLEMS BY BEES
G. A. Mazokhin-Porshnyakov. 17 Oct. 1969 20 p refs Transl. into ENGLISH from Zool. Zh. (Moscow), v. 48, no. 8, 1969 p 1125-1138
(JPRS-49083) Avail: CFSTI

The facility of bees with respect to abstract operations of the generalization type was tested by sequential training to distinguish figures transformed with respect to several parameters. It was demonstrated that bees can recognize triangles and rectangles by the number of angles, that is, independently of the size and projective transformation of the figures. Bees perform the act of abstraction from optical noise in the form of spots and bands, and by abstracting from the type of color, shape and size of the figures, they easily generalize them with respect to the dichroism attribute. Bees even turned out to be capable of such more complex operations as generalization of the figures by the presence of a black circle at the end or in the middle of a chain or a black square outside or inside the figure. The expediency of the behavior of the bees in the described experiments is interpreted as a manifestation of elementary reasoning. It is proposed that there is no theoretical difference in the organization of complex forms of behavior of insects and vertebrates. Author

N69-40854# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONCISE HANDBOOK OF SPACE BIOLOGY AND MEDICINE
A. I. Burnazyan et al. 20 Mar. 1969 477 p Transl. into ENGLISH of the book "Kratkiy Spravochnik vo Kosmicheskoy Biologii i Meditsine" Moscow, Izd. Meditsina, 1967 p 1-368
(AD-691356; FTD-HT-23-835-68) Avail: CFSTI CSCL 6/5

A concise fully cross-referenced and cross-indexed encyclopedic dictionary of current terminology in the fields of space biology and space medicine. In addition, the appendix contains tabular material providing detailed data on respiration, water metabolism, energy, nutrition, physical constants, measurement unit conversion factors and space flights carried out by the USSR. Author (TAB)

N69-40919# Oregon Univ., Portland. Psychology Dept.
ELEMENTARY PROCESSES IN PATTERN PERCEPTION Final Report, 1 Aug. 1965 - 30 Jun. 1969
Fred Attneave. 1969 11 p refs
(Grant AF-AFOSR-973-66)
(AD-691486; AFOSR-69-1873TR) Avail: CFSTI CSCL 5/10

Work accomplished is described under the following headings: (1) Psychophysical scaling. Transportation was used as a scaling method. By this criterion, the musical scale is better than the mel scale. Manitude judgments were analyzed into input and output components. (2) Perceptual grouping. The kinds of homogeneity that provide similarity grouping were investigated. Slope of elements is the highest order variable that gives decisive grouping. (3) Reference systems. The dependence of stimulus classification on orientational frames of reference was studied in a variety of ways. (4) Space perception. The Gestalt principle of Pragnanz is supported by this research. Perceived tridimensional orientation tends to that which is consistent with the simplest object. Author (TAB)

N69-40931# Chicago Univ., Ill. USAF Radiation Lab.
A FURTHER SURVEY OF COMPOUNDS FOR RADIATION PROTECTION Final Report, Jan. 1961 - Apr. 1965
Vivian Pizak and John Doull. Feb. 1969 87 p
(Contract AF 41(609)-2977)
(AD-691490; SAM-TR-69-1) Avail: CFSTI CSCL 6/15

The report summarizes the results obtained with 617 compounds tested for their radioprotective activity in adult male mice irradiated with a control-demonstrated LD(99+) of 800 R (250 kvp) x-rays. A compound was considered to exhibit radioprotective activity if it (1) permitted any of the treated mice to survive for 30 days after the otherwise lethal whole-body x-irradiation or (2) increased the median survival time of treated animals by 5 days or more beyond the median survival time of the untreated control mice (9 plus or minus 3 days). Of the 617 compounds tested, 245 successfully passed one or both of the stated specifications. Additionally, data are offered to allow comparisons of chemically related groups for structure-activity relationships, and to indicate the types of structures which offer the greatest promise as a source of more effective and less toxic radioprotective agents. Author (TAB)

N69-40955*# Union Carbide Corp., Tonawanda, N.Y. Linde Div. Research Lab.
BIOCHEMICAL AND METABOLIC EFFECTS OF A SIX-MONTH EXPOSURE OF SMALL ANIMALS TO A HELIUM-OXYGEN ATMOSPHERE
Robert W. Hamilton, Jr., Janis D. Cohen, Gerald F. Doebbler, Lorenzo F. Exposito, John M. King, et al. Washington NASA Oct. 1969 90 p refs
(Contract NAS2-3900)
(NASA-CR-1372) Avail: CFSTI CSCL 04C

Selected biochemical analyses were made on the parent and two successive generations of mice. These included blood indices, electrophoretically separated tissue protein patterns from liver, skeletal muscle, and cardiac muscle, quantitative determinations

of LDH, MDH, and G6PDH from the same tissues; serum insulin; and semi-quantitative histochemical estimates of liver glycogen. No cases of statistically significant difference or consistent trends were seen between the experimental environmental groups. Additional analyses of liver nucleotides and redox-coenzymes also failed to show a significant difference. The relative weights of liver, heart, kidney, and diaphragm (wet and dry) were the same in both groups. Histopathological examination of kidney and adrenal tissue produced unremarkable findings and none that were attributable to the nature of the gaseous environment. It must be concluded that prolonged exposure to helium - oxygen, relative to air, does not produce detectable changes in several key subcellular factors which might be altered by serious metabolic disturbances, and therefore the helium exposure is well tolerated. Author

N69-40980# Florida Univ., Gainesville. Dept. of Entomology.
CELLULAR INDICATORS OF RADIOSENSITIVITY Final Report, May 1967 - May 1968
Harvey L. Cromroy. May 1969. 109 p. refs. Prepared for Office of Civil Defense, Army
(Contract N00228-67-C-2312)
(AD-691882; TRC-68-49) Avail: CFSTI CSCL 6/18

The research was designed to further substantiate and elaborate on the correlation between interphase chromosome volume and LD50 of a species as an effective predictor of radiation sensitivity. The predictive equations could then be introduced into overall models on ecological effects from a given dose of radiation. The study is subdivided into three areas: plants, insects, and mammals. TAB

N69-40984# California Univ., Los Angeles. Dept. of Anatomy.
ELECTROENCEPHALOGRAPHIC AND BEHAVIORAL STUDIES OF MONOMETHYLHYDRAZINE TOXICITY IN THE CAT Final Report
M. B. Sterman, R. W. Lo Presti, and M. D. Fairchild. Wright-Patterson AFB, Ohio. AMRL, Jun. 1969. 15 p. refs
(Contract AF 33(615)-2822)
(AD-691474; AMRL-TR-69-3) Avail: CFSTI CSCL 6/20

The toxicity of monomethylhydrazine (MMH) administered intraperitoneally in the cat was studied by reference to behavioral and neurophysiological indices. The acute toxicity LD50 value for MMH was established as 15 mg/kg, and the CD50 as 7 mg/kg. Doses of 18, 9, and 5 mg/kg were then studied systematically in an effort to classify lethal, convulsive and subconvulsive symptoms. For these doses, a preconvulsive syndrome was described involving recurrent and sustained symptoms including vomiting, panting, rapid respiration, viscous salivation, hyperactivity and subcortical seizure activity. The onset latency of these symptoms was directly related to dose. Several lines of evidence suggested at least a partial independence between the biochemical and neurophysiological events responsible, on the one hand, for convulsions, and on the other for this preconvulsive syndrome. Convulsions were specifically delayed or prevented in animals trained to suppress movement through the use of a special EEG conditioning technique. Author (TAB)

N69-40988# California Univ., Los Angeles. Dept. of Anatomy.
SUBCONVULSIVE EFFECTS OF MONOMETHYLHYDRAZINE ON RUNWAY PERFORMANCE IN THE CAT Final Report, Jan. 1967 - Nov. 1968
M. B. Sterman, M. D. Fairchild, and H. B. Van Twyver. Wright-Patterson AFB, Ohio. AMRL, Jun. 1969. 14 p. refs
(Contract AF 33(615)-2822)
(AD-691473; AMRL-TR-68-183) Avail: CFSTI CSCL 6/20

Previous neurophysiological and behavioral studies of the toxic propellant UDMH have indicated that its subtle-dose influences can be most effectively evaluated in the cat by reference to trained locomotor performance. To determine similar fundamental information in evaluating monomethylhydrazine (MMH), a related derivative of hydrazine, this same technique was employed. Cats were trained and tested in a special runway apparatus to provide a reliable indication of performance changes over a 6-hour period following the administration of 1, 2, and 4 mg/kg MMH. These low doses significantly altered locomotor performance, both during drug session testing and saline control testing carried out 24 hours later. Within 30 minutes after injection of all three doses of MMH, runway performance was depressed. At 2 and 4 mg/kg, this influence was profound and was associated with overt physiological symptoms of toxicity. A total disruption of performance occurred with 4 mg/kg doses when tested 2-5 hours after administration. Performance was still depressed after 24 hours following 4 mg/kg, but was actually facilitated at this same point following 1 and 2 mg/kg doses. Author (TAB)

N69-41123# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
BACTERIA SENSOR FOR REPROCESSED WATER-MICROBIOLOGY RESEARCH, DESIGN, AND FABRICATION Final Report, 1 May 1967 - 31 Aug. 1968
John A. Geating and Fred P. Rudek. Wright-Patterson AFB, Ohio. AMRL, Feb. 1969. 73 p. refs
(Contract F33615-67-C-1564)
(AD-691471; AMRL-TR-68-173) Avail: CFSTI CSCL 6/11

The results of the developmental research leading to the design and fabrication of a short-time, electronic sensor to monitor the bacteriological quality of reprocessed water aboard spacecraft are reported. The basic sensing capability is furnished by a Coulter Counter that selectively detects and counts particles of bacterial size. Detection is accomplished by comparing the number of bacteria-size particles in the reprocessed water sample at some point in time with a particle count at some future point in time, i.e., following the establishment of conditions necessary to allow growth and multiplication of bacteria. A significant difference between the two counts strongly implies bacterial replication, and therefore the presence of viable organisms in the raw reprocessed water. Author (TAB)

N69-41169*# Naval Aerospace Medical Inst., Pensacola, Fla.
CHANGES IN SUBJECTIVE ESTIMATES OF WELL-BEING DURING THE ONSET AND REMISSION OF MOTION SICKNESS SYMPTOMATOLOGY IN THE SLOW ROTATION ROOM
James T. Reason and Ashton Graybiel. 19 Jul. 1969. 19 p. refs
(NASA Order R-93)
(NASA-CR-106280; NAMI-1083) Avail: CFSTI CSCL 06S

The onset of motion sickness is characterized by a decline in generalized feelings of well-being. In this study an attempt was made to quantify these subjective changes during the experimental production of motion sickness. A simple eleven-point rating scale was used to measure the well-being state. The nature and the time of onset of symptoms were recorded independently. Systematic relationships were obtained between the amount of stimulation required to produce the Malaise III endpoint and the rate of change of well-being. In general, relatively susceptible individuals showed an immediate decline in well-being at the onset of the stimulus which continued to fall sharply until the endpoint was reached. With increasing resistance to motion sickness, this point of rapid decline was proportionately delayed. The point on the rating scale at which this rapid decline began was relatively consistent across all subjects. Various positions along the well-being scale were consistently associated with specific constellations of symptoms. The recovery of well-being, following the cessation of the stimulus, appeared to be slower in individuals of low susceptibility than in those who were highly susceptible. Author

N69-41174*# Naval Aerospace Medical Inst., Pensacola, Fla.
MAGNITUDE ESTIMATIONS OF CORIOLIS SENSATIONS
James T. Reason and Ashton Graybiel. 18 Jul. 1969. 16 p. refs
(NASA Order R-93)
(NASA-CR-106389; NAMI-1082) Avail: CFSTI CSCL 06S

The purpose of the first experiment was to investigate the

nautre of the psychophysical function relating magnitude estimates of the strength of the Coriolis vestibular reaction to the speed of platform rotation. This relationship was investigated under four experimental conditions: 1) eyes closed, head tilt to the right; 2) eyes closed, head tilt left; 3) eyes open, head tilt right; and 4) eyes open, head tilt left. A second experiment compared the relative strengths of the tilt and return motions in the right and left quadrants. In all cases, the extent of the head motion was 30°, and rotation was in the counterclockwise direction throughout. Geometric mean magnitude estimates of Coriolis sensations increased as a power function of angular velocity in all four experimental conditions. Magnitude estimations obtained in the vision-present condition were generally greater than those for the vision-absent condition. For both conditions of visual reference, magnitude estimates relating to the right head tilt were greater than those for the left head tilt. In the second experiment, it was found that the strongest reaction was produced by the return from the left shoulder and the next strongest by the return from the right shoulder. The subjective rankings did not differentiate between the right and left tilt motions. Author

N69-41175*# Naval Aerospace Medical Inst., Pensacola, Fla.
PROGRESSIVE ADAPTATION TO CORIOLIS ACCELERATIONS ASSOCIATED WITH 1-RPM INCREMENTS IN THE VELOCITY OF THE SLOW ROTATION ROOM
James T. Reason and Ashton Graybiel 17 Jul. 1969 19 p refs
(NASA Order R-93)
(NASA-CR-106388; NAMI-1081) Avail: CFSTI CSCL 06S

Ten men with normal vestibular function executed controlled head and body movements at each of ten 1-rpm step increases in the velocity of a slow rotation room. On the completion of each movement, subjects were required to indicate whether or not they had detected sensations of vestibular or somatosensory origin. At each velocity step, the movements were continued until each of twenty-four consecutive movements had elicited a negative response and the subject was judged to be symptom free. When this arbitrary adaptation criterion was reached, the angular velocity was increased by 1 rpm and the procedure repeated. On attaining the criterion at the terminal velocity (10 rpm), the rotation was stopped and the postrotatory phenomena were investigated using the same techniques. The principal finding was that the number of movements necessary to achieve the adaptation criterion was systematically related to the absolute level of angular velocity. The results suggest two findings that are relevant to the construction of an adaptation schedule: (1) rotation may safely commence at 2 rpm; and (2) the number of head movements necessary to achieve adaptation at each step velocity must be graded to the absolute speed of rotation in order to dispense with them in the most economic manner. Author

N69-41282# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MODELING OF THE REGULATORY FUNCTION OF THE CARDIOVASCULAR SYSTEM IN WEIGHTLESSNESS
I. I. Kasyan et al. 21 May 1969 15 p refs Transl. into ENGLISH from Russian J.
(AD-692356; FTD-MT-24-04-69) Avail: CFSTI CSCL 6/19

Electric models of the human cardiovascular system in terrestrial and weightless conditions are presented and discussed. Diagrams of the model are shown for the organism at rest, during functional physical effort, and the change in pulse rate caused by a measured physical effort. Under conditions of weightlessness, execution of ordinary tasks evidently requires much more time than on earth. It is concluded that it will probably be necessary to allot more time for rest during weightlessness so that periodic physical work can be properly executed. Author

N69-41322*# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
EXTRATERRESTRIAL LIFE DETECTION BY ENZYMATICALLY INDUCED EXCHANGE OF O-18 Annual Report, 15 May 1968 - 15 May 1969
Bessel Kok 15 May 1969 10 p refs
(Contract NASw-1735)
(NASA-CR-106454) Avail: CFSTI CSCL 06A

An investigation into extraterrestial life is conducted based not only on earth-like characteristics, but on properties basic to all living systems; enzymatic catalysis of oxygen exchange between water and certain common oxyanions. Investigations are continuing with no conclusive evidence reported. E.H.N.

N69-41335# Lockheed Missiles and Space Co., Palo Alto, Calif.
PATHO-MORPHOLOGICAL AND HISTOCHEMICAL CHANGES IN THE ORGANS OF TURTLES ON BOARD THE ZOND-5 PROBE
N. A. Gaidamakin et al. 1969 12 p refs Transl. into ENGLISH from 18th IAF Conf., Buenos Aires, 1969
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

An experiment was conducted using adult turtles divided into a test group, which was carried aboard the Zond 5 probe, and a control group, which was transported to the cosmodrome and returned to the laboratory. The test animals were subjected to 39 days of starvation, flight factors lasting 7 days, the effect of a tropical climate and conditions associated with a period in the ocean following splashdown, and transportation via ship and aircraft. Total radiation received by the animals did not exceed 3.5 rad. Results of a number of hematological tests, electrocardiography, and a number of pathomorphological and histochemical investigations indicate that the complex of space flight factors, combined with starvation, caused mainly changes of an atrophic nature in the organs. Starvation and transportation to the cosmodrome resulted in less definite tissue atrophy. Finally, comparison of changes occurring in the test and control animals showed that the fundamental structural changes in the turtles were caused by starvation and, to a lesser degree, by space flight factors. A.C.R.

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N69-40074*# General Dynamics/Convair, San Diego, Calif.
THE ORBITAL RESEARCH CENTRIFUGE: CONTINUED DESIGN AND FEASIBILITY STUDY Final Report
8 Jul. 1969 192 p refs
(Contract NAS1-8751)
(NASA-CR-66830; GDC-DCL-69-002) Avail: CFSTI CSCL 05E

A design oriented study examines the practicability of incorporating a relatively large passageway (up to 42 inch diam) through the hub area of an orbital research centrifuge. Details are presented of the configuration required for the evaluation of low-g inertial support for walking mobility, personal hygiene, and bench tasks as well as for performance of a wide range of experimental observation of human physiological response. Preliminary experiment descriptions, spacecraft integration data, performance requirements, and a detailed examination of the centrifuge and its systems are included. Author

N69-40089*# Research Triangle Inst., Durham, N.C.
BIOMEDICAL APPLICATIONS OF NASA SCIENCE AND TECHNOLOGY Quarterly Progress Report, 15 Dec. 1968 - 14 Mar. 1969
James N. Brown 14 Mar. 1969 103 p refs
(Contract NSR-34-004-056)
(NASA-CR-106344; RTI-EU-411; QPR-3) Avail: CFSTI CSCL 06B

Nine transferred applications concerned with the following are described: localized cooling of heart muscle; a biomedical tape

recorder; oxygen content in ichthyological ovarian fluid; an improved EMG electrode for hand therapy; a therapy manipulator for abductor transfer cases; an improved blood vessel constrictor; an implantable valve with remote control from outside of the body; triggering methods from fixed reference point on the EKG waveform; and a simple means for sensing the respiratory function of humans. Five potential transfers are discussed: an electrode vest for EKG measurements; telemetry from wood ducks in natural environment; implantable pressure sensor and telemetry unit for fluid pressure measurement in cranial cavity; electromyography for hand rehabilitation; and an improved splintering material. Fifteen new problems are summarized, and progress with problems previously identified is discussed. Five computer searches and three current awareness searches were conducted in NASA aerospace literature.
K.W.

N69-40147# General American Transportation Corp., Niles, Ill. General American Research Div.
CARBON DIOXIDE REMOVAL SYSTEM OF THE REGENERABLE SOLID ADSORBENT TYPE
G. A. Remus, P. P. Nuccio, and R. J. Honegger Mar. 1969 57 p refs
(Contract AF 33(615)-1369)
(AD-690602; AMRL-TR-68-120; Rept-1253-8590) Avail: CFSTI CSCL 6/11

The development of a regenerable carbon dioxide removal system is discussed. The system utilizes solid zeolites to adsorb carbon dioxide and silica gel for predrying the gas stream. The system is completely regenerable, operates automatically and continuously, and provides for storage of the removed carbon dioxide. It is operable over a wide range of cabin environments and provides flexibility in varying the system operating parameters. It may be used to determine the thermodynamic requirements of a flight-type system for a particular cabin gas composition. The system can remove the carbon dioxide from four crewmen and maintain the carbon dioxide partial pressure between 4 and 5 mm Hg absolute at atmospheric pressure operation and between 6 and 7 mm Hg when operating at 350 mm Hg total pressure. It has this removal capacity when the cabin atmosphere is composed of 13 mm Hg water vapor partial pressure, 160 mm Hg oxygen partial pressure and either nitrogen or helium as the makeup gas. An external control console is provided which permits the system to be operated in an unmanned chamber. The system is not optimized for power and weight; as a laboratory model the total average power required is 4000 watts and the total weight including the mounting frame is 250 pounds.
Author (TAB)

N69-40266# Litton Systems, Inc., Minneapolis, Minn. Applied Science Div.
INVESTIGATIONS OF HEAT AND MASS (WATER VAPOR AND LIQUID) MOVEMENT THROUGH CLOTHING SYSTEMS Final Report, 25 Jun. 1965 - 24 Jun. 1966
R. E. Larsen, L. W. Rust, A. R. Kydd, and G. A. Gauvin Sep. 1968 171 p refs
(Contract DA-19-129-AMC-683(N))
(AD-691144; USA-NLABS-C/OM-TR-69-31-CM-56) Avail: CFSTI CSCL 11/5

The report discusses research of the investigations of heat and mass (water vapor and liquid) movement through clothing systems and summarizes the results of a theoretical and experimental research program. Experimental studies included measurements of profiles of mean and fluctuating velocity, temperature, and water vapor concentration for various fabric spacings and ventilating velocities. Transfer coefficient data obtained from these profiles were compared with total water and heat loss rates.
Author (TAB)

N69-40301*# George Washington Univ., Washington, D.C.
TECHNOLOGY ASSESSMENT
Raphael G. Kasper, ed. Jul. 1969 171 p refs Presented at the Seminar Ser., Program of Policy Studies in Sci. and Technol., Washington, D.C., Jan.-Apr. 1969 Sponsored by NASA
(NASA-CR-106302) Avail: CFSTI CSCL 05B

CONTENTS:

1. ASSESSMENT INFORMATION SYSTEMS C. H. Danhof p 1-20 refs (See N69-40302 24-34)

2. TECHNOLOGY ASSESSMENT AND THE CONGRESS R. A. Carpenter p 33-46 refs (See N69-40303 24-34)

3. THE ADVERSARY PROCESS IN TECHNOLOGY ASSESSMENT H. P. Green p 59-78 refs (See N69-40304 24-05)

4. THE MANAGEMENT OF TECHNOLOGY ASSESSMENT L. H. Mayo p 89-150 refs (See N69-40305 24-05)

N69-40304*# George Washington Univ., Washington, D.C.
THE ADVERSARY PROCESS IN TECHNOLOGY ASSESSMENT
Harold P. Green *In its* Technol. Assessment Jul. 1969 p 59-78 refs Sponsored by NASA (See N69-40301 24-05)
Avail: CFSTI CSCL 05B

The importance of introducing an adversary process, defined as a mechanism to permit articulation of negative facts related to a technological development, into the assessment procedure is stressed. Such a mechanism is required to identify and control the attributes of a technology which adversely affect basic individual rights that have traditionally been protected by the legal system; of particular concern are those incidents which may threaten public health, safety, and security. Previous ad hoc attempts at creating an organization for this purpose are cited as failures, and it is proposed that there is a need for an agency charged solely with the function and responsibility to probe for negative factors, to identify them, and to press them vigorously upon the Congress and the public. It should be totally independent of the government or function as a part of the Congress. In this way, it is felt that the proponents of technology will be compelled to present their recommendations for development in a language comprehensible to the layman, and that the final decisions will be made through ordinary political processes.
A.C.R.

N69-40305*# George Washington Univ., Washington, D.C.
THE MANAGEMENT OF TECHNOLOGY ASSESSMENT
Louis H. Mayo *In its* Technol. Assessment Jul. 1969 p 89-150 refs Sponsored by NASA (See N69-40301 24-05)
Avail: CFSTI CSCL 05B

The frequently advanced notion of a Total Problem Approach to technology assessment is discussed, and a tentative suggestion is offered for one type of institutional arrangement which might produce a close approximation to this goal. It is stressed that such an arrangement would supplement and coordinate the existing technology assessment function and would not supplant it. A brief overview is presented of past and current trends in the area of technology assessment and several major deficiencies are suggested. The establishment of a neutral group of assessment centers is proposed as a first step for providing timely and reliable input into the final Congressional evaluation. The Total Problem approach would be used to monitor the performance of technology assessment systems relevant to each of the major techno-social problem areas, to recommend optimum social subsystems for interim assessments, to identify opportunities for applying technology to social problems, and to seek out and publicize existing or prospective detrimental impacts.
A.C.R.

N69-40328# Stanford Univ., Calif. Dept. of Computer Science.
STANFORD ARTIFICIAL INTELLIGENCE PROJECT
John Mc Carthy Jun. 1969 101 p refs
(Contract ARPA SD-183; ARPA Order-457)
(AD-691789; AI-MEMO-87) Avail: CFSTI CSCL 6/4

Plans and accomplishments of the Stanford Artificial Intelligence Project are reviewed in several areas including: theory (epistemology and mathematical theory of computation), visual

perception and control (Hand-eye and Cart), speech recognition by computer, heuristics in machine learning and automatic deduction, models of cognitive processes (Heuristic DENDRAL, Language Research, and Higher Mental Functions). Author (TAB)

N69-40432# School of Aerospace Medicine, Brooks AFB, Tex.
BATTERY LIFE AND MOISTURE PENETRATION OF SUBDERMALLY IMPLANTED DEVICES Final Report, Mar. 1967 - Mar. 1968
Henry Buchanan, Willis F. Moore, and Calvin R. Richter Jun. 1969 17 p refs
(AD-691348; SAM-TR-69-33) Avail: CFSTI CSCL 9/6

Tests were conducted to determine cause of relatively short and variable life spans of subdermally implanted electronic devices. The investigation was restricted to body fluid penetration of the epoxy case used for the implanted device and to operational life span of the power supply. Samples of the epoxy used for the implant cases were checked for rate of moisture absorption, and life tests were conducted on the power supply of the implant. The tests consisted of actual animal implantations and simulated implanted conditions in the laboratory. Results indicate the commercial epoxy used for the implant cases was imprevious to body fluids for the length of the test period. Cause of short and variable life span of implanted devices is attributed to the type of mercury batteries used. Author (TAB)

N69-40522# Systems Technology, Inc., Hawthorne, Calif.
RANDOM SAMPLING REMNANT THEORY APPLIED TO MANUAL CONTROL
Warren F. Clement Mar. 1969 116 p refs
(Contract N00014-68-C-0443)
(AD-691843; TM-183-A) Avail: CFSTI CSCL 5/8

The theory comprises stochastic finite-dwell sampling among displays with continuous control output based on cardinal reconstruction theory. Random sampling remnant theory introduces the notion of stability in the mean-square sense in the operators closed-loop tracking performance. A related regression of adopted crossover frequency is shown to be sensitive to the controllers sampling remnant. Foveal or parafoveal finite dwell sampling and intersample control output reconstruction suppress sampling remnant. A suppressed remnant will enable the operator to adopt ratios of sampling-to-crossover frequency more nearly approaching the lower bound predicted by the generalized sampling theorem. Two examples illustrate the practical application of the theory to displays for manual control. The influences of finite dwell and intersample reconstruction suggest that sampling remnant may offer a powerful practical measure for trading off the number and types of displays in a multiloop control situation. Author (TAB)

N69-40540# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USE OF CONTINGENT STATUS INFORMATION IN DIAGNOSTIC PERFORMANCE AND RELATED ASPECTS FOR INFORMATION DESIGN, JANUARY - MAY 1967
Robert G. Mills Dec. 1968 28 p refs
(AD-691806; AMRL-TR-68-135) Avail: CFSTI CSCL 5/8

The ability of observers to use stimulus relationships in making predictive or diagnostic decisions is investigated and implications of this area of research for application to man-machine systems are considered. Observers were required to make predictive estimates of the state of a system based on observations of sequentially presented qualitative subsystem status information. The status information was derived from four-cell contingency tables containing event frequencies and quantified by a correlation coefficient which varied from approximately 1.0 to -1.0. Results indicate: (a) that observers estimates appear to be based on the relative frequency of cell events as opposed to a correlation solution; (b) there is greater accuracy when estimates are based on positive relationships; and (c) observers are capable of only very gross discrimination between various levels of relationship. Conclusions generally considered how these results might be used in designing the information structure of man-machine systems such that an operators decision performance would be facilitated. Author (TAB)

N69-40624# Isomet Corp., Palisades Park, N.J.
A SOLID ELECTROLYTE CARBON DIOXIDE REDUCTION SYSTEM Final Report, Dec. 1967 - Sep. 1968
Horace W. Chandler and Lawrence J. Howell Apr. 1969 81 p refs
(Contract F33615-68-C-1173)
(AD-691844; AMRL-TR-68-177) Avail: CFSTI CSCL 6/11

An investigation of solid electrolyte cells utilizing a 90 mole % ZrO2-10 mole % Y2O3 electrolyte and platinum electrodes for the reduction of carbon dioxide to carbon monoxide and oxygen was carried out. At 1000 C, oxygen production efficiency is less than 50% when the cell is operated at a current density greater than 0.040 amp/cu cm on a dry CO/CO2 mixture as cathode feed. Reduction of the solid electrolyte because of insufficiently rapid transfer of oxygen from the cathode feed gas to the cathode is the direct cause of low current efficiency. Reduction of the electrolyte can lead to formation of a two-phase region in the electrolyte which can, in turn, result in permanent damage to the electrolyte. The presence of water vapor in the feed mixture of CO and CO2 decreases cell polarization, decreases electrolyte reduction and increases oxygen production efficiency. Author (TAB)

N69-40703# British Air Line Pilots Association, Hayes (England).
THE PILOT REQUIREMENT IN AUTOMATION, SIMULATION AND DATA HANDLING
H. A. Hopkins *In* Brit. Air Line Pilots Assoc. Automation, Simulation and Data Handling in Civil Aviation 1968 p 4-10 (See N69-40702 24-02)
Avail: CFSTI

In discussing the use of automation in the airline industry, emphasis is placed on the pilot-machine interface. Problem areas in computerized flight planning, air traffic control, and weather forecasting are briefly treated. Areas of greatest potential for the application of automated procedures are identified as air-ground communication systems, graphic navigation displays, and recording of engine and aircraft performance data for safety monitoring. The development of a special simulator for pre-production cockpit assessment is cited as a vital step toward insuring that the cockpit environment is matched to human limitations before the aircraft is put into commercial service. A.C.R.

N69-40777*# McDonnell-Douglas Astronautics Co., Santa Monica, Calif. Advance Biotechnology and Power Dept.
EVALUATION OF DESORBATES FROM A REGENERATIVE CARBON DIOXIDE REMOVAL SYSTEM USED IN A 60-DAY MANNED TEST
P. P. Mader, M. L. Rodin, and R. A. Neustein Oct. 1969 35 p refs
(Contract NASw-1539)
(NASA-CR-106214; MDC-G1192) Avail: CFSTI CSCL 06K

Desorbates from silica gel and molecular sieve beds used as a part of a regenerative CO_2 removal unit in a life support system during a 60-day manned test were identified and quantified. The capacities of these two sorbers to adsorb and accumulate trace contaminants from the cabin atmosphere were compared. Material desorbed from activated charcoal of the toxin control subsystem was subjected to qualitative analysis. The results indicated that a significant amount of organic compounds was released from the silica gel and molecular sieve beds during the regenerative cycle. The daily reduction in organic contaminant level in the simulator (4,100-ft^3 volume) amounted to approximately 7.7 parts per million. The operation of the water recovery system inside the space station simulator inadvertently led to the formation of sizable quantities of ammonia because of incomplete pretreatment of urine. It was effectively adsorbed by the silica gel sorbent beds. The

silica gel unit helped remove the ammonia from the cabin at a faster rate than the water recovery post-treatment system could accomplish alone. Author

N69-40815# Michigan Univ., Ann Arbor. Psychology Dept.
PROCESSING OF SEQUENTIALLY PRESENTED SIGNALS IN INFORMATION COMBINING TASKS
Arthur S. Kamlet. Jun. 1969. 63 p. refs. US Army Human Eng. Lab. Aberdeen Res. and Develop. Center
(Contract AF 49(638)-1235)
(AD-691728; TM-9-69) Avail: CFSTI. CSCL 5/10

Human performance theory has relied heavily upon an experimental paradigm in which speeded performance, or reaction time, is measured as a function of the time intervening between two successive stimuli. The study examined a special form of the two-signal paradigm in which the first stimulus provided the rule or operator for defining the appropriate response to the second stimulus. This form of the two-signal experimental paradigm is called an information-combining task. The aim of the present series of experiments was to examine temporal factors in an information-combining task in order to discriminate among alternative human performance theories. Specifically, the number of alternative operators and the number of alternative second signals were independently varied over a range of intervals between the operator and the second signal. In some tests the interstimulus interval was held constant from trial to trial; in other tests the interstimulus interval varied between successive trials. The findings rejected single-channel theories of information processing in favor of a flexible, capacity-sharing model. The results also suggested that subjects performed sophisticated strategy adjustments to take advantage of subtle features of these information-combining tasks. Author (TAB)

N69-40900# IIT Research Inst., Chicago, Ill.
METEOROID THREAT TO EXTRAVEHICULAR SPACE SUIT ASSEMBLIES. Final Report, 1 Mar. 1966 - 1 Mar. 1967
Frank J. Zimmerman. Jun. 1969. 23 p. refs
(Contract AF 33(615)-3468)
(AD-691461; AMRL-TR-68-86) Avail: CFSTI. CSCL 6/17

This report utilizes most recent meteoroid flux data and illustrates the method used in calculating the probability of meteoroid puncture for a space-suited crewman in earth orbit. An example of the method is shown and uncertainties in the prediction are reviewed. Finally, guidelines are presented that could be followed in planning an experimental program of penetration studies on space suit materials intended to resolve some of these areas of uncertainty. Author (TAB)

N69-40956# Applied Psychological Services, Wayne, Pa. Science Center.
A FORCED-CHOICE INSTRUMENT FOR EVALUATING VISUAL INFORMATION DISPLAYS
Arthur I. Siegel, M. A. Fischl, and Douglas H. Mac Pherson. Apr. 1969. 79 p. refs
(Contract N00014-66-C-0183)
(AD-687182) Avail: CFSTI. CSCL 5/8

An instrument (called the analytic profile system (APS)) for visual display evaluation was developed and subjected to an initial validation. The APS is based on seven factors derived from a multidimensional scaling analysis of the display-observer interface. Prose statements (items) were prepared covering these dimensions, were scaled for favorableness, and were then arranged in tetrad forced-choice format. The report presents results of investigations into the dimensional homogeneity, and into the concurrent validity, equivalence, and stability of the developed instrument. A copy of the final form is included. Author (TAB)

N69-41053*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
MEASUREMENT AND DISPLAY OF CONTROL INFORMATION. REMOTE MANIPULATION AND MANUAL CONTROL. Progress Report, 1 Oct. 1968 - 31 Mar. 1969
Thomas B. Sheridan and William R. Ferrell. 31 Mar. 1969. 47 p. refs
(Grant NGR-22-009-002)
(NASA-CR-106365; DSR-70283-10) Avail: CFSTI. CSCL 05H

In the remote manipulation study, data from a delay-lag experiment were modeled for the general case of human supervision in informational and/or decision theory terms. Initial tests were conducted on an air jet touch display, with emphasis on a hardware demonstration. An inductive displacement transducer was built for a remote-touch sensor. Formal data structures were studied for computer-aided planning of manipulation task execution. In the manual control study, work is summarized on behavioral sources of suboptimal human performance in discrete control tasks. A program, an experimental procedure, and the theory of a limited-preview, goal-directed maze solver are described. The effects of task complexity on operator performance were analyzed, and results of a study of two-person games with continuous variables are summarized. K.W.

N69-41267# Naval Electronic Systems Command, Patuxent River, Md.
TECHNICAL MANUALS, HUMAN FACTORS, AND SYSTEM EFFECTIVENESS
Joseph B. Blankenheim. 22 May 1969. 24 p. Presented at the System Performance Effectiveness Conf., 22 May 1969
(AD-691418) Avail: CFSTI. CSCL 5/2

The technical manual is the link between the man and his machine, and, effectiveness for the system can only be realized if the manual is adequate. The use of human factor engineers to assist in the procurement of manuals is one method of improving manuals. Author (TAB)

N69-41362 Defence Research Establishment Toronto, Downsview (Ontario).
AN ANALOGUE COMPUTER ANALYSIS OF THE DOUBLE PENDULUM PROBLEM
L. A. Kuehn and R. S. Weaver. Jan. 1969. 51 p. refs
(DRET-724) Copyright: Avail: Issuing Activity

A model of a parachute - man - seatpack system descending to the ground, based on a double pendulum system, is developed. Exact and approximate equations of motion of the system are discussed. Solutions of these equations by analog computation are presented and compared with the exact and approximate mathematical solutions. The effects of damping and forcing functions are also considered. The practical implications of this analysis are discussed briefly. Author

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N69-40018# Kernforschungszentrum, Karlsruhe (West Germany).
CHARACTERISTICS OF SODIUM
A. Pee. Feb. 1969. 93 p. refs. In GERMAN
(KFK-924; EUR-4168) Avail: AEC Depository Libraries

A number of FORTRAN-4-functions were described with which the entropy of sodium could be calculated in the temperature range from 260 to 1400°C. NSA

N69-40035# Brookhaven National Lab., Upton, N.Y.
RADIATION CHEMICAL NITROGEN FIXATION IN AIR WATER SYSTEMS
Shoichi Sato and Meyer Steinberg. Mar. 1969. 24 p. refs
(BNL-13692) Avail: CFSTI

Nitrogen fixation by ^{60}Co γ rays in an air - water system

was studied under bubbling air conditions. Two main products, ammonium and nitrite were analyzed and yields were obtained with varying pH of the solution and flow rate of air. The effect of pH showed that ammonium formation was favored by low pH but its oxidation to nitrite was favored by high pH. The G-values, calculated for the total amount of the dissolved and bubble air, for nitrite formation were 1.9 to 3.8 for 0.01 to 0.5 N NaOH and 0.6 to 1.0 for 0.01 to 0.5 N H_2SO_4 and for ammonium formation almost zero for NaOH solutions and 40 to 76 for the H_2SO_4 solutions. The effect of air flow rate on the average bubble diameter was studied. The G-values of ammonium and nitrite were for neutral water 5 to 14 and 1.4 to 1.6, based on the total amount of air in the system, depending on the flow rate, and were higher than the values for dissolved air which were 2.3 and 0.8, respectively. From the difference, G-values of nitrite were obtained based on the amount of air existing in the bubbles, which showed a similar trend proportional to the reciprocal of the bubble diameter. Author (NSA)

N69-40052# Adelaide Univ. (Australia). Physics Dept.
PHOTOELECTRON SPECTROSCOPY FOR SOME AUTOIONIZED STATES OF MOLECULAR OXYGEN
J. L. Bahr, A. J. Blake, J. H. Carver, and Vijay Kumar. Jan. 1969 21 p refs
(Grant AF-AFOSR-1131-66)
(AD-690653; ADP-68) Avail: CFSTI CSCL 7/4

Photoelectron spectra have been measured at wavelengths corresponding to several autoionized resonance states of O2 in the region above 775 A, and also at neighbouring off-resonance wavelengths. The off-resonance spectra show a single broad maximum in the strength of the O2(+) vibrational structure which is close to the energy corresponding to the adiabatic ionization potential. However, the resonance spectra have additional features which are characteristic of the vibrational quantum number of the autoinized resonance. The form of these spectra may be reproduced theoretically by the calculated Franck-Condon factors for the autoionizing transitions provided that the equilibrium inter-nuclear distance for the autoionized state is introduced as an adjustable parameter. Author (TAB)

N69-40068# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THIN FILM RARE-EARTH POLONIDES
J. H. Jarrett and D. W. Brite. Jun. 1969 24 p refs
(Contract AT(45-1)-1830)
(BNWL-1113) Avail: CFSTI

The results of an investigation of the reaction of polonium-210 vapor with rare-earth films are reported. Handling techniques and reaction conditions required for preparation of thin films of rare-earth polonides with good integrity and optimum thermal stability above 1000°C are described. Rare-earth polonide compounds having the greatest thermal stability were obtained by reaction at 1200°C and removal of excess polonium by distillation at 1200°C. Author (NSA)

N69-40070# Oak Ridge National Lab., Tenn. Chemical Technology Div.
LIQUID-VAPOR EQUILIBRIA IN Li-F-BeF 2 AND LiF-BeF 2-ThF 4 SYSTEMS
F. J. Smith, L. M. Ferris, and C. T. Thompson. Jun. 1969 24 p refs
(Contract W-7405-ENG-26)
(ORNL-4415) Avail: CFSTI

Liquid vapor equilibrium data for several LiF-BeF_2 and LiF-BeF_2-ThF_4 systems were obtained by the transpiration method over the temperature of 900 to 1050°C. Relative volatilities, effective activity coefficients, and apparent partial pressures are tabulated for the major components, as well as for solutes such as UF_4, ZrF_4, CsF, RbF, and some rare-earth fluorides. The values are in reasonable agreement with those reported in the literature. Results of this study show that distillation may not be feasible as a primary separations method in the processing of single-fluid MSBR fuels. Author (NSA)

N69-40102*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEPOSITION AND EVALUATION OF SILICON FILMS FORMED BY PYROLYTIC DECOMPOSITION OF SILANE ON OXIDIZED SILICON SINGLE CRYSTALS
Archibald Linley Fripp, Jr. (M.S. Thesis, Virginia Univ.) Jun. 1969 68 p refs
(NASA-TM-X-61916) Avail: CFSTI CSCL 07D

The chemical deposition of silicon on thermally grown silicon dioxide has been investigated. The reactant was semiconductor-grade silane (SiH_4) in an induction-heated hydrogen flow system. The deposit was found to be polycrystalline with a strong (110)-preferred orientation which tended toward a random orientation at high temperatures. A geometrical model, based on the possible second near the neighbor positions of silicon atoms in the amorphous silicon dioxide, is proposed which offers an explanation for the strong (110) orientation for moderate temperatures and the near random orientations for high temperatures. Author

N69-40107 Missouri Univ., Columbia.
EFFECT OF POTASSIUM ON THE VOLTAGE GRADIENT AND THE POWER DENSITY OF THE POSITIVE COLUMN IN A MERCURY VAPOR DISCHARGE TUBE
James Donald Bruce (Ph.D. Thesis) 1968 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-3364

Data are presented along with discussion of theoretical basis and applications of a low pressure gaseous discharge in mercury vapor seeded with small percentages of potassium. An externally heated tungsten filament cathode was used, and by employing the technique of a movable anode the distance between the electrodes was made variable. This allowed the collection of data which indicated that the seeding of mercury vapor with small amounts of potassium resulted in lowering the voltage gradient of the positive column compared to that of pure mercury vapor. The average data also indicated that the required input power to sustain the discharge was lowered by such seeding. Dissert. Abstr.

N69-40153# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW SYNTHESIS OF POLYBENZIMIDAZOLES
V. V. Korshak et al. 9 Jun. 1969 5 p refs Transl. into ENGLISH from Vysokomolekul. Soedin., Ser. B: Kratkiye Soobshch. (Moscow), v. 10, no. 7, 1968 p 481 - 482
(AD-691653; FTD-HT-23-279-69) Avail: CFSTI CSCL 7/3

Polybenzimidazoles were synthesized from adipamide dihydrochloride, diethyl diiminoadipate dihydrochloride and 3,3-diaminiobenzidine, and also from adiponitrile and 3,3-diaminobenzidine tetrahydrochloride both in melt and in N-methylphrolidinone solution. The melting temperatures and the solubilities of poly prepared by these methods approached those of polybenzimidazoles of a similar structure prepared from diphenyl adipate and 3,3-diamino-benzidine. The polymers are light-brown powders soluble in sulfuric and formic acids, dimethylformamide, dimethylsulfoxide, dimethylacetamide, and other solvents. The reduced viscosity of 0.5 percent solution of the polymers in formic acid at 25 degrees C was 0.5 dl/g. The structure of the polymer was confirmed by IR-spectroscopy and elemental analysis. Author (TAB)

N69-40156# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
STUDY OF THE CATALYTIC ACTIVITY OF MIXED NON-STOICHIOMETRIC URANIUM-THORIUM OXIDES IN

CARBON MONOXIDE OXIDATION [ETUDE DE L'ACTIVITE CATALYTIQUE DES OXYDES MIXTES D'URANIUM ET DE THORIUM NON STOECHIOMETRIQUES DANS L'OXYDATION DU MONOXYDE DE CARBONE]

Guy Brau (Ph.D. Thesis) Jun. 1969 78 p refs In FRENCH; ENGLISH summary
(CEA-R-3794) Avail: CFSTI

The aim of this work has been to study the catalytic properties of non-stoichiometric uranium-thorium oxides having the general formula $U_xTh_{1-x}O_{2+y}$, for the oxidation of carbon monoxide. The preparation of pure, homogeneous, isotropic solids having good structural stability and a surface area as high as possible calls for a strict control of the conditions of preparation of these 2 H_2O. A study has been made of their physico-chemical properties (overall and surface chemical constitution, texture, structure, electrical conductivity), as well as of their adsorption properties with respect to gaseous species occurring in the catalytic reaction. This analysis has made it possible to put forward a reaction mechanism based on successive oxidations and reductions of the active surface by the reactants. A study of the reaction kinetics has confirmed the existence of this oxidation-reduction mechanism which only occurs for oxides having a uranium content of above 0.0014. The carbon dioxide produced by the reaction acts as an inhibitor by blocking the sites on which carbon monoxide can be adsorbed. These non-stoichiometric mixed oxides are a particularly clear example of catalysis by oxygen exchange between the solid and the gas phase.
Author (ESRO)

N69-40169 Rensselaer Polytechnic Inst., Troy, N.Y.

ANISOTROPY OF THERMAL CONDUCTIVITY IN ORIENTED LINEAR AMORPHOUS HIGH POLYMERS

Basil Daniel Washo (Ph.D. Thesis) 1968 197 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-2489

A theory which has successfully treated the effect of molecular weight on polymer thermal conductivity has been extended to treat the effect of molecular orientation on thermal conductivity. Thermal conductivity–orientation characteristics were experimentally determined for polystyrene (PS) and a series of characterized polymethylmethacrylates (PMMA). The theory predicts a positive, linear relationship between orientation and thermal conductivity parallel to the direction of orientation (stretching). The corresponding conductivity perpendicular to the draw is shown to be functionally related to the thermal conductivity parallel to the draw. Experimental results on PS and the PMMA series are completely consistent with these predictions. In addition, thermal conductivity–orientation characteristics are predicted in general to be solely a function of molecular weight (d.p. N) and a parameter a, characterizing the relative inter- to intra-molecular energy transport ability.
Dissert. Abstr.

N69-40199# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.

ORGANIC CHEMISTRY SECTION: SUMMARY OF ACTIVITIES Annual Progress Report, 1 Jul. 1968–30 Jun. 1969

Robert Schaffer, ed. Oct. 1969 147 p refs
(NBS-TN-507; APR-5) Avail: SOD $1.25

Reported is new work on carbohydrates and polyhydroxy cyclic compounds, and analytical studies leading to the development of standard reference materials for clinical chemistry. In research on carbohydrates, rules on selective hydrolysis of certain ketose acetals, a new crystalline derivative of potential use as an SR, for "D-ribulose," conformations of compounds having m- and p-dioxane rings, and a synthesis of ^{15}N-labeled "6-amino-D-glucose" are described. Work on polyhydroxy cyclic compounds has shown that (1) phenylosotriazoles of diketoinositols favor a half-chair conformation; (2) mercuric acetate is a superior reagent for preparing these osotriazoles; (3) acetylation in 100% phosphoric acid gives an octaacetoxydibenzo-p-dioxin from 4,6/5-trihydroxy-1,2,3-cyclohexanetrione; (4) periodic acid oxidize[illegible]razino to phenylazo derivatives; and (5) phenylformazans an[illegible] bis(phenylhydrazones) form highly colored salts with [illegible]ong acid.
Author

N69-40215# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.

CONTRIBUTION TO THE SOLUTION CHEMISTRY OF URANIUM (VI)[CONTRIBUTION A LA CHIMIE DE L'URANIUM (VI) EN SOLUTION]

Claude Tsymbal (Ph.D. Thesis–Grenoble Univ., 15 Dec. 1967) Jul. 1969 103 p refs In FRENCH; ENGLISH summary
(CEA-R-3476) Avail: CFSTI

In the first part, a potentiometric study of the complexes formed by the uranyl ion with the hydroxy ligand has been performed. Evidence is presented for the existence of the following complexes with their respective stability constants (determined at 25°C in 0.1M ClO_4Na medium): UO_2OH, $\log\beta_{1,-1} = -4.39$; $(UO_2)_2OH$, a similar investigation has been undertaken on the complexes formed by the uranyl ion with carbonate and/or hydroxyl ligands; the latter appearing in neutral or acid media.
Author (ESRO)

N69-40240*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ELECTROCHEMICAL BEHAVIOR OF THE ALUMINUM ELECTRODE IN MOLTEN SALT ELECTROLYTES

Betty S. DelDuca Washington Oct. 1969 30 p refs
(NASA-TN-D-5503) Avail: CFSTI CSCL 07D

The kinetics for dissolution and deposition of solid aluminum in molten $AlCl_3$-NaCl and $AlCl_3$-(LiCl-KCl)$_{eut}$ electrolytes were studied by means of galvanostatic and potentio-static techniques over a temperature range of 175° to 313°C (448 to 586 K). The apparent exchange currents varied from 1 to 56 mA/cm^2. Surface diffusion was found to be the rate-determining step at low overpotentials, and charge transfer the rate-determining step at high overpotentials. The most probable anodic rate-determining step was found to be $Al \rightarrow Al^{+} + e^{-}$; the most probable cathodic rate-determining step was $Al^{+++} + e^{-} \rightarrow Al^{++}$ in $AlCl_3$-(LiCl-KCl)$_{eut}$ electrolyte and $Al^{++} + e^{-} \rightarrow Al^{+}$ in $AlCl_3$ - NaCl electrolyte. Current efficiencies for dissolution were close to 100 percent.
Author

N69-40279 Illinois Univ., Urbana.

PHASE RELATIONS IN THE SYSTEM URANIUM-SULFUR-OXYGEN

Peter Dean Shalek (Ph.D. Thesis) 1968 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-1441

Phase relations were established in the uranium-sulfur-oxygen system, using a wedge melting point apparatus to obtain much of the high temperature data. Two new low temperature phases were identified in the uranium-sulfur-oxygen system. They are UO_2 and U_3O_8 structural phases which retain sulfur. Uranium oxysulfide has a large solubility for UO_2 because of its layered structure, and its structure has a definite relationship to that of UO_2. Uranium monosulfide has a small oxygen solubility at high temperatures and exists as a $U_{1-x}S$ phase in hyperstoichiometric compositions. US is not soluble in UO_2 and forms a simple eutectic system with this compound. Liquids in the US-UO_2 pseudobinary system behave as regular solutions. Study of equilibrium relations in the U-S-O system is complicated by the tendency of UOS and U_2S_3 to decompose, both in the solid state and from their solutions. In all cases, there is a net loss of sulfur.
Dissert. Abstr.

N69-40333*# Techtran Corp., Glen Burnie, Md.

PHOTOLYSIS OF CERTAIN PRECURSORS OF NUCLEIC ACIDS IN THE PRESENCE OF POLYPHOSPHORIC ACID

[FOTOLIZ NEKOTORYKH PREDSHESTVENNIKOV NUKLEINOVYKH KISLOT V PRISUTSTUIY POLIFOSFORNOY KISLOTY]

Ye. M. Lapinskaya. Washington: NASA, Oct. 1969. 8 p. refs. Transl. into ENGLISH from Zh. Evolyutsionnoi Biokhim. i Fiziol. (Moscow), v. 5, no. 1, 1969 p. 10-15.
(Contract NASw-1695)
(NASA-TT-F-12571) Avail: CFSTI; CSCL 07C

Liquid aqueous solutions of uracile, uridine, adenine and adenosine, both liquid and frozen at −78°, were subjected to the effects of ultraviolet irradiation both in the presence of polyphosphoric acid (PPA) and without it. It was discovered that the polyphosphoric acid influences the photolysis of uracile, adenine and their nucleosides at room temperature and at −78°; the decomposition of uracile increases, and the formation of peroxide compounds in uridine and adenosine also increases. Chromatographic analysis was used to show that at high radiation doses splitting of the bases from the nucleosides occurs. In the presence of PPA, the bases are separated at lower doses. The very low temperatures do not prevent the photochemical reactions in the pyrimidines or in the purines. The catalytic influence of PPA also appears. The investigation performed may be of significance in the analysis of the problem of the chemical evolution of the precursors of the nucleic acids. Author

N69-40335# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN ORGANIC CORROSION INHIBITORS FOR TITANIUM IN SULFURIC ACID, PART 2

A. P. Brynza et al. 31 Jan. 1969. 7 p. refs. Transl. into ENGLISH from Ukr. Khim. Zh. (Kiev), v. 33, no. 8, 1967 p. 843-846.
(Contract F33657-68-D-0865/P002)
(AD-692045; FTD-HT-23-977-68) Avail: CFSTI; CSCL 7/4

The corrosive and electrochemical behavior of titanium was studied in 5 N sulfuric acid solutions with admixtures of para-, meta- and orthonitrobenzoic acids. It is shown that these admixtures, like other nitro derivatives, inhibit the corrosion of titanium. A characteristic feature of the action of these inhibitors, once a certain concentration is reached, is their ability to provide complete corrosion protection to titanium by shifting its steady-state potential to the passivation range. It is shown that these inhibitors sharply inhibit the anodic process, decreasing the passivation current several-fold, and facilitate the cathodic process as a result of their own electroreduction. The dependence of the cathodic polarization on the inhibitor concentration and rate of stirring of the solution was studied. The inhibition of the cathodic process upon transition to the range of hydrogen polarization is due to obstacles of a diffusional order. Author

N69-40348# Research Triangle Inst., Durham, N.C. Camille Dreyfus Lab.

THE RADIATION-INDUCED POLYMERIZATION AND COPOLYMERIZATION OF UNUSUAL MONOMERS

V. T. Stannett, D. T. Turner, D. Campbell, Y. P. Castille, H. G. Clark et al. 8 Jan. 1968. 145 p. refs.
(Contract AT(40-1)-2513)
(TID-24923) Avail: CFSTI

A number of ketones and ring compounds were studied. These were the radioinduced copolymerization of liquid formaldehyde with styrene and the polymerization of crystalline trithiane. The formaldehyde-styrene copolymers had considerably enhanced thermal stabilities, but were produced at low G-values. Among a number of other vinyl monomers studied, a few formed polyoxymethylenes of comparative thermal stabilities but at very high G values. A detailed study was also conducted on the copolymerization and terpolymerization of sulfur dioxide with dienes and vinyl monomers. Good yields of polymers were obtained in many cases. Among the terpolymers synthesized, soluble and fusible polymers had reasonable thermal stabilities. A number of monomer pairs which polymerized in eutectic mixtures were discovered and studied. The β-propiolactone-styrene system, yielded a mixture of the two homopolymers; the acrylonitrile-β-propiolactone and the N-vinylcarbazole-N-phenylacrylamide systems formed essentially random copolymers. Speculations concerning the mechanism of copolymerization are also presented. Author (NSA)

N69-40358# Harry Diamond Labs., Washington, D.C.

CALCULATED STARK PROFILES FOR THE HELIUM GAMMA 4026 ANGSTROM LINE AND ITS FORBIDDEN COMPONENTS

Harry A. Gieske. Mar. 1969. 31 p. refs.
(AD-691335; HDL-TR-1407) Avail: CFSTI; CSCL 7/4

Profiles of the helium I 4026.19A (2 triplet P - 5 triplet D) line, including contributions from the forbidden 2 triplet P - 5(triplet S, triplet P, triplet F, triplet G) transitions have been calculated using the quasi-static approximation to account for ion effects and a generalized impact approximation to describe electron effects. Tabulated profiles of the line absorption coefficient are presented which, in addition to Stark broadening, allow for the fine structure splitting of the lower level. Author (TAB)

N69-40367# Aerojet-General Corp., San Ramon. Nuclear Div.

ALKALI METALS EVALUATION PROGRAM: SURFACE TENSION AND CONTACT ANGLE OF LITHIUM AND SODIUM, VOLUME 3

P. Y. Achener. Apr. 1969. 81 p. refs.
(Contract AT(04-3)-368)
(AGN-8191-Vol-3) Avail: CFSTI

The surface tension and contact angle of pure lithium were determined at temperatures from 210 to 617°C and 206 to 563°C, respectively. The surface tension and contact angle of lithium containing various amounts of nitrogen impurities were determined at temperatures from 224 to 514°C. The surface tension and contact angle of lithium containing 3000 ppM oxygen were determined at temperatures from 212 to 545°C and the surface tension and contact angle of sodium containing from 37 to 190 ppM oxygen at temperatures from 114 to 564°C. The maximum bubble pressure method was used for the surface tension determinations and the dip tube method for the contact angle determinations. The tests were performed with a specially designed apparatus fabrication from Type 410 stainless steel. The capillary tubes and the dip tube were made of Type 304 stainless steel. Author (NSA)

N69-40377# Naval Electronics Lab. Center for Command Control and Communications, San Diego, Calif.

TWO-PHOTON ABSORPTION IN ALKALI HALIDES. CALCULATION OF NONLINEAR OPTICAL ABSORPTION COEFFICIENTS Research and Development Report, Mar. – Dec. 1968

H. F. Taylor. 13 Mar. 1969. 43 p. refs.
(AD-691800; NELC-1619) Avail: CFSTI; CSCL 7/4

Values of the two-photon absorption coefficient have been predicted for nine of the alkali halides. There are indications that RbI and NaBr are more sensitive to two-photon absorption than materials studied previously. These findings have implications for the development of three-dimensional storage devices. Author (TAB)

N69-40385# Army Foreign Science and Technology Center, Washington, D.C.

LUMINESCENCE OF GLASSES ACTIVATED BY FERRIC IRON

S. G. Lunter. 27 Jun. 1969. 10 p. refs. Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 8, no. 6, Jun. 1968.
(AD-691317; FSTC-HT-23-377-6916) Avail: CFSTI; CSCL 20/6

Luminescence spectra of phosphate, borosilicate, and silicate glass containing 0.3-0.5 wt. % Fe_2O_3 were studied in the

300-900 nm region. Absorption spectra taken in the 0.2-4.5 micrometer region are also presented. Data are compared for various glasses with manganese versus iron activators. Author (TAB)

N69-40392# Puerto Rico Nuclear Center, Mayaguez.
HOT-ATOM CHEMISTRY PROGRAM Progress Summary Report, Apr. 1968 - Apr. 1969
Apr. 1969 45 p refs
(Contract AT(40-1)-1833)
(PRNC-130) Avail: CFSTI

Studies are being made of the mechanism of Szilard-Chalmers processes in organic compounds. Metallocenes and metal carbonyls were used in the studies. The ^{125}Sb products formed in the neutron activation of phenyl tin compounds were identified. Recoil reactions in dicyclopentadienyl compounds as osmium and rhenium were studied. The radioactive products formed in a neutron activation of aromatic selenium and tellurium compounds were identified. Mechanisms were determined. Mechanisms of hot-atom reactions of aromatic phosphorus compounds in benzene solutions were investigated. NSA

N69-40398# Puerto Rico Nuclear Center, Mayaguez.
MATRIX ISOLATION STUDIES OF THE GAMMA RADIOLYSIS OF HETEROCYCLIC MOLECULES
A. Grimison and G. A. Simpson Apr. 1969 88 p refs
(Contract AT(40-1)-1833)
(PRNC-128; PR-4) Avail: CFSTI

Thermoluminescence of γ-irradiated adenine, cytosine, DNA, guanine, thymine, and uracil was studied. The ESR spectra of irradiated cytosine and uracil are also given. The luminescence of indole, indazole, purine, aniline, triphenylamine, and tetraphenylpyrrole was investigated in a study of photoionization of heterocyclics. Excitation energies and valence bonds are being calculated for radical anions and cations of heterocyclic molecules. NSA

N69-40403# Carnegie-Mellon Univ., Pittsburgh, Pa. Radiation Research Labs.
RADIATION RESEARCH REPORTS Quarterly Report, 1 Apr. - 30 Jun. 1969
3 Jul. 1969 16 p refs
(Contract AT(30-1)-2310)
(RRL-2310-276) Avail: CFSTI

Progress is reported on electron reactions in the gas phase, electron scavenging in methanol and ethanol, transient solvated electron in pulse-irradiated viscous 1-propanol, positive ion scavenging in hydrocarbons, effect of scavengers on cyclohexane radiolysis, the rate of CF_3 addition to C_2H_4 in liquid hydrocarbons, recombination rate constant for methyl radicals, further studies of CF_3OOO, ESR observations of H atoms in the radiolysis of water, and electron scavenging in irradiated viscous hydrocarbons. NSA

N69-40418# IIT Research Inst., Chicago, Ill.
DETECTION AND IDENTIFICATION OF CHEMICAL SIGNATURES
A. Dravnieks and B. K. Krotoszynski May 1969 183 p
(Contract DA-18-001-AMC-954(X))
(AD-691738; IITRI-C609313) Avail: CFSTI CSCL 7/4

In the work on the detection and identification of human chemical signatures, experimental and computerized statistical techniques were first developed, tested, and standardized. The experimental techniques solved the problems of sample collection, recovery, injection into the gas chromatograph, calibration and characterization of signature components. The sample collections were based on the principle of equilibration and were performed by means of Apiezon L-coated Teflon powder in the form of a fluidized bed. The collected samples were transferred into a special injector needle by means of an IITRI-designed transfer system. The injection of samples into the gas chromatograph was performed in a timed, automatic and reproducible manner with a specially constructed injection system. The calibration method permitted correlation of the concentrations of known signature components in air with their respective peak areas. The sensitivity of this novel process is of the order of one part per billion (by volume) of an organic component in air. Author (TAB)

N69-40423*# Radio Corp. of America, Princeton, N.J.
VAPOR PHASE GROWTH TECHNIQUE AND SYSTEM FOR SEVERAL 3-5 COMPOUND SEMICONDUCTORS Quarterly Technical Report
J. J. Tietjen, R. Clough, A. B. Dreeben, and R. E. Enstrom Jun. 1969 14 p
(Contract NAS12-538)
(NASA-CR-106371; QTR-7) Avail: CFSTI CSCL 07D

Research has continued on the vapor growth of GaN, $In_{1-x}Ga_xP$, and $Ga_{1-x}Al_xAs$ alloy layers. Several p-type conducting layers of GaN were achieved by doping with Ge acceptor impurities, but reproducibility is a problem. Experiments designed to reduce the inherent donor concentration in the GaN to improve the p-doping reproducibility were not successful. However, as a result of these experiments the electronic mobility was increased to 150 cm^2/v-sec, which is the highest value yet observed. Rapid diffusion of Zn from the p-type $In_{1-x}Ga_xP$ alloy p-n junction layer into the GaAs substrate was eliminated by reducing the p- and n-type doping concentrations. As a result, $In_{1-x}Ga_xP$ electroluminescent diodes containing 40 and 88% GaP were prepared that emitted at 7300 Å and 5700 Å, respectively. An investigation of process variables showed that the composition of In_2Ga_8P alloy samples is relatively insensitive to the temperature of the Ga and In sources and to the phosphine flow rate which indicates that control of alloy composition is best achieved by controlling the relative flows of HCl over the In and Ga sources. Efforts to improve the reproducibility of high AlAs content $Ga_{1-x}Al_xAs$ alloys by varying gas flow rates, substrate and source temperatures, and source size were not successful.

N69-40433# Institute of Nuclear Physics, Krakow (Poland).
SOLVENT EXTRACTION AND SEPARATION OF SOME LATHANIDES AND AMERICIUM BY EXTRACTION CHROMATOGRAPHY IN THE SYSTEM ALIQUAT-336 LITHIUM NITRATE AND NITRIC ACID
Ignacy Stronski Jan. 1969 15 p
(INP-675) Avail: AEC Depository Libraries

The liquid–liquid extraction of La, Nd, Eu, Ho, and Am nitrates by means of the radiotracer method in the system tricaprylmonomethyl ammonium nitrate (Aliquat-336) - lithium nitrate and nitric acid was investigated. The mixture of tracer quantities of Eu - Am, Nd - Pr, Sm - Pm, Gd - Eu, Er - Ho, Tm - Er, Yb - Tm, and Lu - Tm were separated by column partition chromatography. Author (NSA)

N69-40434# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemistry.
THE RING CURRENT OF THE PHTHALOCYANINE RING
Thomas R. Janson, Alexander R.Kane, John F. Sullivan, Kerro Knox, and Malcolm E. Kenney Jul. 1969 26 p refs Submitted for publication
(Contract Nonr-1141(18))
(AD-690782; TR-6) Avail: CFSTI CSCL 7/4

Some simple classical current-loop calculations have been carried out on the phthalocyanine ring. Data for the calculations have been supplied by some single-ring and multi-ring silicon and germanium phthalocyanines. Possible structural uses are foreseen for the results. Author (TAB)

N69-40457*# Marquardt Corp., Van Nuys, Calif.
RESEARCH ON LOW VOLTAGE ELECTROLUMINESCENT DEVICES WITH STORAGE, PHASE 2 Final Technical Report
Jacques M. Hanlet Mar. 1969 57 p refs
(Contract NAS12-545)

(MASA-CR-86259; Rept-25284) Avail: CFSTI CSCL 20B

During the course of this contract, monocrystalline films of ZnTe and ZnSe were produced over large areas by epitaxial deposition in vacuum. A new method of chalcogene evaporation was originated which permits close control of the polymerism in the vapor state and thereby the point defect density. Two forms of heterojunction were investigated and produced over large areas; both were operable at room temperature in scotopic conditions. It can be concluded that as better hold on the II-VI compounds technology is gained, the greater the potential of their application will become towards useful electroluminescent devices. Author

N69-40465# Oak Ridge National Lab., Tenn. Chemical Technology Div.

RATES OF GAS EVOLUTION FROM THE REACTIONS OF URANIUM AND THORIUM CARBIDES WITH AQUEOUS SOLUTIONS OF HCl, SULFURIC ACID, NaOH, AND AMMONIUM FLUORIDE

Mildred Bradley Sears and Leslie M. Ferris (Contract W-7405-eng-26)

(ORNL-4381) Avail: CFSTI

Gas evolution as a function of time, is shown graphically for the reactions of 3- to 4-g specimens of arc-cast uranium and thorium carbides with aqueous solutions of HCl, H_2SO_4, NaOH, and NH_4F. Author (NSA)

N69-40530# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.

FORMATION AND STRUCTURE OF SUBSTITUTED CARBONYL HALOGENIDES OF OSMIUM AND RUTHENIUM [BILDUNG UND STRUKTUR SUBSTITUIERTER CARBONYLHALOGENIDE VON OSMIUM UND RUTHENIUM]

Peter John (Ph.D. Thesis) 3 Jul. 1968 102 p refs In GERMAN

Avail: CFSTI

Polymeric ruthenium carbonyl iodide and dimeric osmium carbonyl chloride were reacted in benzene at 50° to 160° C with a large number of organic donor ligands. Formation and structure of the resulting unpolar and ionic compounds were analyzed by measuring the dipole moments and the IR and UV absorption spectra. The ligands included amines, organyls, of phosphorus and its homologs, and organochalcogenides. Under mild conditions, two-nuclei substituted carbonyl derivatives of the composition $[Os(CO)_2LCl_2]_2$ (L = As and Se organyls) were isolated. With ruthenium it was in some cases possible to separate monocarbonyl compounds of the type $Me(CO)L_3X_2$. The formation tendency was found to depend strongly on the organic rests of the donor atom and is considerably greater for alkylized ligands than for aromatic derivatives. Isomeric structures were proven in several cases, from which the partial dipole moments of several important metal-ligand bonds were calculated. The results may be useful in a theoretical interpretation of the bonds of these complexes. Transl. by K.W.

N69-40536 National Lending Library for Science and Technology, Boston Spa (England).

POLYFLUORINATED HETEROCYCLIC COMPOUNDS. PART 2: SYNTHESIS OF HETEROCYCLIC COMPOUNDS BASED ON ALPHA-BENZAMIDO-BETA (PENTAFLUOROPHENYL) ACRYLIC ACID

T. D. Petrova et al. [1969] 8 p refs Transl. into ENGLISH from Khim. Getorotsiklich. Soedin. (USSR), no. 5, 1968 p. 771-776

(NLL-M-7665-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl. 1 NLL photocopy coupon

The possibility of intramolecular cyclization of α-benzamido-β (pentafluorophenyl) acrylic acid was investigated in relation to the preparation of heterocyclic systems. It was found that the heating of the acid with potassium fluoride in dimethyl formamide produces 3-benzamido-6,7,8,9-tetrafluoro coumarin. The 2-phenyl-4-carbomethoxy-6,7,8,9-tetrafluorobenz (f) oxazepine-1,3 is formed in the same way from the methyl ester of the acid. Some reactions of this oxazepine derivative are examined. Author

N69-40551# Ballistic Research Labs., Aberdeen Proving Ground, Md.

AIR-LIKE DISCHARGES WITH CARBON DIOXIDE, NITRIC OXIDE, NITROGEN PEROXIDE, AND NITROUS OXIDE AS IMPURITIES

Franklin E. Niles Jun. 1969 68 p refs

(AD-690816; BRL-1437) Avail: CFSTI CSCL 4/1

Computer solutions to 24 time-rate-of-change equations have been obtained for airlike discharges attainable in a laboratory facility designed for the study of reactions of ionospheric importance. The manner in which the solutions are affected by initial number densities of CO2, NO, NO2, and N2O, corresponding to impurity levels of 0, 0.1, 10, and 1000 ppm, is presented. The effects of principal reactions on the number densities of detectable species are discussed. For the conditions specified in the computer program, the initial NO2 density greatly affects the negative ion densities and the initial NO density greatly affects the observable positive ion densities. Author (TAB)

N69-40570# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Chemistry Research Lab.

THE EFFECT OF BURNING VELOCITY INHIBITORS ON THE IGNITION OF HYDROCARBON-OXYGEN-NITROGEN MIXTURES

M. E. Morrison and K. Scheller Apr. 1969 36 p refs

(AD-691793; WSCI-69-14) Avail: CFSTI CSCL 21/2

It has been proposed that the mechanism of inhibition by halogens in hydrocarbon flames involves an increase in ignition temperature with a consequent prolongation of the preignition zone. An examination of this hypothesis was undertaken by a systematic investigation of the effect of a number of well-recognized burning velocity inhibitors on the ignition of hydrocarbon mixtures by hot wires in a 35 mm quartz tube. Data are reported for ignition temperature as a function of additive concentration for methane and/or propane mixtures with oxygen and nitrogen at ambient temperature and pressure. Author (TAB)

N69-40580# Stanford Research Inst., Menlo Park, Calif.

TRANSPORT COEFFICIENTS OF GAS MIXTURES OF ATOMIC AND MOLECULAR HYDROGEN

Henry Wise Jun. 1969 11 p refs Prepared in cooperation with Purdue Univ.

(Contract N00014-67-A-0226-0005)

(AD-691446; TR-SRI-28-PU) Avail: CFSTI CSCL 7/4

An analysis was made of the viscosity and diffusion coefficients of a binary mixture containing atomic and molecular hydrogen on the basis of a specific interaction potential curve. The theoretical results obtained with the aid of the Chapman-Enskog theory are compared with experimental data. The good agreement obtained indicates that for a system containing species with unfilled outer electronic shells the application of realistic force laws to the interaction yields satisfactory estimates of the transport coefficients. Author (TAB)

N69-40590# Stevens Inst. of Tech., Hoboken, N.J. Chemistry and Chemical Engineering Dept.

DIFFUSIONAL PHENOMENA IN FLOWING POLYMER SOLUTIONS. PART 1: THEORY OF RESOLUTION DISPERSION IN GEL PERMEATION CHROMATOGRAPHY

J. A. Biesenberger and A. Ouano 29 Jul. 1969 23 p refs

(Contract N00014-68-A-0131)

(AD-691466; ONR-TR-9) Avail: CFSTI CSCL 7/4

A systems approach is applied to the analysis of chromatogram resolution dispersion, or zone broadening, in Gel Permeation Chromatography (G.P.C.). Three possible sources of dispersion are considered, these are: the packed columns, the empty tubing

between pump and columns, columns and detector, etc., and the detection system, viz., the differential refractometer cell. It is shown that empty tubing can contribute significantly to the degree of dispersion and to skewness of elution curves and that this dispersion should depend on molecular weight of solute (polymer) and diameter and length of the tubing. The importance of dispersion in the empty tubing is compared with that in the packed columns and refractometer cell. Author (TAB)

N69-40610# Naval Scientific and Technical Information Centre, London (England).

SOME PROBLEMS OF USING HIGH-TEMPERATURE ORGANIC COOLANTS

O. A. Dibrov. May 1969. 5 p. Transl. into ENGLISH from Khim. Prom. (Leningrad), v. 25, no. 8, 1968 p 589

(AD-691874; NSTIC-TRANS-2134) Avail: CFSTI CSCL 11/7

A brief report is presented as to why there is a need to summarize all of the data on organic coolants. Such data should include coolant toxicity and fire hazards. TAB

N69-40646# Army Nuclear Defense Lab., Edgewood Arsenal, Md.

HYDROGEN AND HYDROGEN PEROXIDE PRODUCED BY GAMMA RADIOLYSIS OF OXYGEN-SATURATED WATER

Ronald A. Sasse. Jun. 1969. 38 p. refs

(Contract DA-1-B-062104-A-089)

(AD-691327; NDL-TR-122) Avail: CFSTI CSCL 7/5

Pure, oxygen-saturated water was irradiated with 60Co gamma radiation. At low doses, G(H2O2) was 2.6. At doses greater than 2000 rad, G(H2O2) was 1.33. Over the entire dose interval G(H2) was constant at 0.17. The G values of 1.33 and 0.17 agree with published data. Many experiments are presented to form the argument that G(H2O2) = 2.6 is not the result of an impurity reaction and that this value is the initial yield. This high G value was measured by two different purification procedures. The results are compared with the presently accepted mechanism for the radiolysis of oxygen-saturated water and the conclusion is reached that this mechanism is in error at least in the low dose range. Another mechanism is developed to account for the experimental results where H2O(+) and e(-) are proposed as the primary species in the radiolysis of water. Author (TAB)

N69-40665# Central Inst. for Industrial Research, Blindern (Norway).

STUDIES OF HIGH TEMPERATURE OXIDATION OF HAFNIUM-NIOBIUM ALLOYS

P. Kofstad and I. Kvernes. *In* Plansee Soc. for Powder Met., 6th Plansee Seminar Preprints, Vol. 1, 1968, 37 p. refs (See N69-40651 24-17)

(St-1853/1K/kmf) Avail: CFSTI

Oxidation of binary Hf-Nb alloys with 10 to 50w/oNb has been studied in the temperature range 800 - 1300°C. The experimental methods included thermogravimetric measurements of oxidation rates and studies on reacted specimens by means of X-ray diffraction, metallographic techniques, and electron microprobe analysis. The major reaction products were HfO_2, Nb_2O_5, and Nb_2O_5·$6HfO_2$, and the relative amounts of these were a function of temperature, oxygen pressure, and elapsed time of reaction. At 10 torr O_2 and higher oxygen pressures oxidation of the binary alloys exhibits an irregular temperature dependence and goes through a maximum 950 - 1000°C. Above 1100°C the oxidation rate again increases with temperature. At and below 0.1 torr O_2 the maximum in oxidation rate is absent. At certain temperatures the pretreatment of the specimens may influence the oxidation rate. The binary Hf-Nb alloys exhibit comparatively rapid oxidation rates; and at the maximum in oxidation at 900 - 1000°C the rates are as fast as for unalloyed niobium. Author

N69-40675# Kernforschungsanlage, Juelich (West Germany).

THE SOLIDIFICATION OF URANIUM MONOCARBIDE URANIUM MONONITRIDE MIXED CRYSTAL POWDERS BY HOT PRESSING METHOD [DAS VERDICHTEN VON UC-UN-MISCHKRISTALLPULVERN NACH DEM HEISSPRESSVERFAHREN]

A. Naoumidis, U. Brinkmann, and H.-J. Stoecker. *In* Plansee Soc. for Powder Met., 6th Plansee Seminar Preprints, Vol. 2, 1968, 31 p. refs In GERMAN (See N69-40674 24-17)

Avail: CFSTI

Studied was the hot pressing behavior of uranium monocarbide - uranium mononitride powder mixtures in graphite matrices. Carbon diffusion was eliminated by substituting the vacuum with regulated nitrogen pressure during the pressing process. Results showed that the density of the U(C,N)-mixed crystals depended on the temperature; density increased with increasing temperature without reaching a maximum. Transl. by G.G.

N69-40676# Plansee Society for Powder Metallurgy, Reute (Austria).

THE REACTIONS OF HIGH MELTING POINT SILICIDES WITH NITROGEN AND OXYGEN [DIE REAKTIONEN HOCHSCHMELZENDER SILIZIDE MIT STICKSTOFF UND SAUERSTOFF]

E. Fitzer and K. Reinmuth. *In its* 6th Plansee Seminar Preprints, Vol. 2, 1968, 57 p. refs In GERMAN (See N69-40674 24-17)

Avail: CFSTI

Thermodynamic and experimental data are evaluated in order to obtain reaction probabilities of titanium, vanadium, niobium, tantalum, molybdenum, and tungsten silicides with nitrogen. Free formation energies and entropy data are calculated from reaction temperature reversals between silicides, nitrides, and nitrogen and are then used to supplement the thermodynamic data of high melting point silicides. Results show that molybdenum and tungsten silicides are stable in pure nitrogen at temperatures above 1575°C and disilicides of niobium and tantalum at temperatures above 1800°C. Stable nitrides are formed below 1800°C with titanium, and below 1550°C with vanadium, niobium, and tantalum. All described equilibrium phases were obtained by disilicide nitration with molecular nitrogen. Kinetic oxidation behavior studies on pure sintered metal silicides establish the rapid surface layer growth on $MoSi_2$ up to the barrier effect and its decomposition resistance at oxydation temperatures of 500°C. This kinetic reaction mechanism is similar to reaction kinetics of silicium and silicium carbide with an activation energy of 40 kcal/Mol for the parabolic layer growth above 1400°C; vaporization above this temperature limits the SiO_2 layer thickness. Transl. by G.G.

N69-40678# Plansee Society for Powder Metallurgy, Reute (Austria).

THE CHEMICAL DIFFUSION OF CARBON IN THE GROUP VI-B METAL CARBIDES

R. J. Fries, J. E. Cummings, C. G. Hoffman, and S. A. Daily. *In its* 6th Plansee Seminar Preprints, Vol. 2, 1968, 30 p. refs (See N69-40674 24-17)

Avail: CFSTI

The chemical diffusion of carbon in tungsten, molybdenum, and chromium carbides was studied by measuring the growth rates of the carbide layers on appropriate metal samples. The rate-determining step of the diffusion process was found to be the diffusion of the carbon through the carbide phases. Grain boundary diffusion was unimportant. Tungsten carbide layer growths were studied over the range 1500° to 2535°C. Below 2400°C, only the W_2C layer growth is important, although a thin WC skin is observed. The growth of the molybdenum carbides was studied from 1200° to 2100°C. Below ≈1415°C, Mo_2C growth with an activation energy of 114 kcal/mole is observed, while above this temperature the activation energy is only 68 kcal/mole. These observations are related to the order - disorder transition that occurs in the carbon sublattice of Mo_2C at about 1400°C. Above ≈1800°C, both Mo_2C and MoC layer growths were observed, but the MoC growth rate was found to be limited by the supply of

carbon to the surface of the sample. The diffusion of carbon into chromium was studied from 1200° to 1475°C. In this case, three carbide layers are found: a thin outside layer of Cr_3C_2 on a much thicker layer of Cr_7C_3 which, in turn, surrounds a thin layer of $Cr_{23}C_6$. Author

N69-40679# Los Alamos Scientific Lab., N. Mex.
CARBON DIFFUSION IN THE CARBIDES OF URANIUM
T. C. Wallace, W. G. Witteman, C. L. Radosevich, and M. G. Bowman. *In* Plansee Soc. for Powder Met., 6th Plansee Seminar Preprints, Vol. 2, 1968, 45 p, refs. Sponsored by AEC. (See N69-40674 24-17)
Avail: CFSTI

The chemical diffusion coefficient of carbon in UC_x (face centered cubic, B1 structure type) has been determined as a function of composition and temperature. The heat of chemical diffusion has a maximum value of 142.5 ± 21.3 kcal/mole at approximately $UC_{1.3}$. U_2C_3 (body centered cubic, space group $I\bar{4}3d$) and α-UC_2 (body centered tetragonal, space group I^4/mmm) layer growths were studied over the temperature ranges 1185° to 1780° and 1525° to 1780°C, respectively. Carbon self-diffusion coefficients were calculated from the experimental data and known thermodynamic data. From thermal diffusion experiments it is shown that the apparent heat of transport is positive for the single and two phase regions studied in the composition range. Author

N69-40685# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorwerkstoffe.
ON OXYGEN DETERMINATION IN URANIUM CARBIDE AND NITRIDE COMPOUNDS AS WELL AS IN HIGH TEMPERATURE STABILIZED METAL CARBIDES [UEBER DIE SAUERSTOFFBESTIMMUNG IN CARBIDISCHEN UND NITRIDISCHEN SOWIE IN HOCHTEMPERATURSTABILEN METALLCARBIDEN]
H. Nickel and J. Rottmann. *In* Plansee Soc. for Powder Met., 6th Plansee Seminar Preprints, Vol. 2, 1968, 36 p, refs. In GERMAN; ENGLISH summary. (See N69-40674 24-17)
Avail: CFSTI

A bathless hot extraction method was developed in order to determine the oxygen content of powdered carbides of uranium and of transition elements of the IVa, Va and VIa group of the periodic table. A stream of nitrogen was used as a carrier gas. In order to know the degassing reaction process, thermodynamic calculations as well as X-ray diffraction, and chemical and metallographic analysis were carried out on samples which had been outgassed in a stream of nitrogen at temperatures of 1500° and 2000°C respectively. The results have shown that during the oxygen extraction from the carbides of uranium, titanium, zirconium, and hafnium nitrogen does not only serve as a carrier gas but also leads to a quick and complete oxygen reduction due to the formation of stable carbonitrides. By avoiding the use of molten-metal bath the nitrogen carrier gas method presents the following advantages: (1) the disturbing effect of graphite precipitations in the liquid metal on the dissolution and outgassing processes is avoided; (2) gas losses due to gettering by vaporised metal are avoided; and (3) the possibility of using the graphite crucible several times and of saving capsules and bath materials reduces the cost. Author

N69-40689# Office National d'Etudes et des Recherches Aerospatiales, Paris (France).
COATING PROBLEMS [COATINGPROBLEME]
H. Bueckle. *In* Plansee Soc. for Powder Met., 6th Plansee Seminar Preprints, Vol. 2, 1968, 2 p. In GERMAN. (See N69-40674 24-17)
Avail: CFSTI

Aluminum fluoride containing silicon donors were used to obtain 30 to 40 μm thick molybdenum silicon layers in one hour long vapor deposition at 700°C. This method avoided the loosening of the crystal nucleus during recrystallization and produced adhesive, fracture and oxidation resistant layers of low brittleness. Transl. by G.G.

N69-40691# Plansee Society for Powder Metallurgy, Reute (Austria).
SILICON DIFFUSION IN PROTECTIVE SILICIDE PHASE LAYERS OF HIGH MELTING POINT METALS [SILIZIUMDIFFUSION IN SCHUTZSCHICHTBILDENDEN SILIZIDPHASEN HOCHSCHMELZENDER METALLE]
E. Fitzer and K. Matthias. *In its* 6th Plansee Seminar Preprints, Vol. 2, 1968, 36 p, refs. In GERMAN. (See N69-40674 24-17)
Avail: CFSTI

Quantitative comparison of a molybdenum silicon layer on molybdenum substrate, obtained either through selective silicon oxidation or silicon diffusion into the molybdenum nucleus, established the advantage of the diffusion method. Reaction kinetics of the molybdenum silicon phases and layer thickness measurements in the 1200° to 1700°C temperature region were used to calculate the diffusion coefficient for the Mo_5Si_3 phase and the corresponding $MoSi_2$ layer consumption. It was shown that intermediate layers of tungsten and tantalum reduce diffusion velocity and delay the consumption of the $MoSi_2$ phase during diffusion. Transl. by G.G.

N69-40693# Wien Univ. (Austria). Institut fuer Physikalische Chemie.
THE CHEMICAL BOND IN MATERIALS WITH A HIGH MELTING POINT [DIE CHEMISCHE BINDUNG IN HOCHSCHMELZENDEN STOFFEN]
A. Neckel and H. Nowotny. *In* Plansee Soc. for Powder Met., 6th Plansee Seminar Preprints, Vol. 3, 1968, 16 p, refs. In GERMAN. (See N69-40692 24-17)
Avail: CFSTI

This survey presents the various theories for strong metal-nonmetal bonds in materials of high melting points with emphasis on transition metal carbides. Quantitative and qualitative models for chemical bonds are developed by evaluating chemical valences, band structures, geometric structures, as well as quantum mechanical and tight-binding approximation calculations. Characteristic properties of all complex carbides and nitrides are their short bond separations between metal and nonmetal in comparison with corresponding binary carbide structures. Transl. by G.G.

N69-40694# Plansee Society for Powder Metallurgy, Reute (Austria).
CONFIGURATION MODEL OF LOCALIZED VALENCE ELECTRONS [KONFIGURATIONSMODELL DER LOKALISIERTEN VALENZELEKTRONEN]
G. V. Samsonov. *In its* 6th Plansee Seminar Preprints, Vol. 3, 1968, 35 p, refs. In GERMAN. (See N69-40692 24-17)
Avail: CFSTI

The described configuration localization model for valence electrons in transition metals utilizes a majority of localized electrons to form covalent bonds during filling of the d-shell of the isolated atom. The quota of non-localized valence electrons is determined by the exchange with localized electrons as well as by their interactions with each other. Transl. by G.G.

N69-40722# Institute of Nuclear Physics, Krakow (Poland).
INVESTIGATION ON THE SEPARATION OF SOME LANTHANIDES AND ACTINIDES BY EXTRACTION CHROMATOGRAPHY IN THE SYSTEM DI-(2-ETHYLHEXYL)-ORTHOPHOSPHORIC ACID-HYDROCHLORIC ACID [UNTERSUCHUNGEN UEBER DIE TRENNUNG VON EINIGEN LANTHANIDEN UND ACTINIDEN MITTELS DER EXTRAKTIONSCHROMATOGRAPHIE IM SYSTEM DI-(2-AETHYLHEXYL)-ORTHOPHOSPHORSAEURE-SALZSAURE]
Ignacy Stronski. Jan. 1969, 18 p, refs. In GERMAN
(INP-674) Avail: AEC Depository Libraries

The extraction and reextraction processes of some chlorides of lanthanides and actinides were investigated by partition chromatography. Chromatographic columns with powdered polytrifluoromonochloroethylene (KEL-F) supporting bis(2-ethylhexyl othophosphate (HDEHP) were used. The optimal conditions of separation of trace amount of trivalent (or divalent) ions of Eu-Gd, Eu-Tb, Ho-Er, Tm-Lu, Yb-Lu as well as Am-Eu, Am-UO_2, and Am-PuO_2 were found. The influence of irradiation on the solid supports and extractant with γ quantums of ^{60}Co nuclides were also studied. Author (NSA)

N69-40726# Rensselaer Polytechnic Inst., Troy, N.Y. Chemistry Dept.
MOLTEN THALLOUS NITRATE MERCURIC CHLORIDE MIXTURES AS CONCENTRATED ELECTROLYTES
G. J. Janz, A. Timidei, and F. W. Dampier Jul. 1969 28 p refs
(Contract N00014-67-A-0117-0006)
(AD-691458; TR-1; RPI-441.39) Avail: CFSTI CSCL 7/4

The density, molar volume, electrical conductance and viscosity of molten TlNO3 containing increasing amounts of HgCl2 are reported over the temperature range: 182-282 C and for a limited composition range of TlNO3-rich mixtures. The Masson Equation of aqueous concentrated electrolytes is found to hold for the partial molar volume of TlNO3 in these molten mixtures. The molar volume data, and the changes in conductance and viscosity are qualitatively understood, in large part, if the NO3(-)-HgCl2 interactions are analogous to the solvation forces of aqueous electrolytes. No evidence of discontinuities in these properties is noted at the compositions corresponding to the two congruently melting compounds: TlNO3-HgCl2 and 2TlNO3.HgCl2. Author (TAB)

N69-40769# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aerospace Medical Div.
WATER ELECTROLYSIS CELLS USING HYDROGEN DIFFUSION CATHODES
Edwin S. Kolic and John E. Clifford Feb. 1969 73 p refs
(Contract F33615-67-C-1515)
(AD-691464; AMRL-TR-68-157) Avail: CFSTI CSCL 7/4

A matrix based on diamond powder was satisfactory for extended use over 200 C electrolyte temperature in oxygen-generating electrolysis cells using Pd-25Ag hydrogen diffusion cathodes and operating on a water-vapor feed. Over 2500 hours of essentially 100% hydrogen transmission was demonstrated with a small experimental cell containing: 6.35 mm OD x 0.13 mm wall Pd-25Ag tube cathode; platinum screen anode; 250-420 micron-size diamond powder matrix initially impregnated with 80 wt % sodium hydroxide electrolyte. The cell was evaluated in an experimental unit that maintained the cell temperature at 210 plus or minus 4 C and the water-vapor generator at 78 C to provide a water-vapor feed at 340 mm Hg partial pressure for operation at 37 ma/cu cm cathode current density with a cell voltage of 1.54 volts. A separate evaluation of Pd-25Ag cathode alone in a free-electrolyte at 145 C and 37 ma/cu cm was extended to over 16,000 hours of satisfactory performance for hydrogen diffusion. Experiments on the use of phosphoric acid electrolyte was Pd-25Ag cathodes at 37 ma/cu cm showed that satisfactory hydrogen diffusion was limited to about 45 hours and could be attributed to contamination resulting from anodic corrosion of platinum anodes at 80 C in 85 wt % H3PO4. Author (TAB)

N69-40790# Bureau of Mines, Washington, D.C.
CHEMICAL RECLAIMING OF SUPERALLOY SCRAP
Parkman T. Brooks, G. M. Potter, and D. A. Martin Nov. 1969 32 p refs
(BM-RI-7316) Avail: Issuing Activity

This study describes a process for recovering nickel, cobalt, molybdenum, and chromium contained in complex waste superalloy grindings that, for lack of an economical domestic recovery process, are being largely marketed abroad. The process, devised by laboratory scale operations, includes scrap preparation, dissolution of metallics in hot chlorinated acidic liquor, carbon adsorption, three successive solvent extraction separations, and selective chemical precipitations. Nearly 90 percent of the nickel, cobalt, molybdenum, and chromium were separated and recovered as oxides, carbonates, and basic sulfate products. Author

N69-40795# Catholic Univ. of America, Washington, D.C. Vitreous State Lab.
INADEQUACIES OF VISCOSITY THEORIES FOR VITREOUS POTASSIUM NITRATE-CALCIUM NITRATE
H. Tweer, N. Laberge, and P. B. Macedo Jul. 1969 23 p refs
(Contract N00014-68-A-0506; Proj. THEMIS)
(AD-691450; TR-3) Avail: CFSTI CSCL 7/4

The viscosity of 60% NKO3 - 40% Ca(NO3)2 (% mole) was measured by the beam-bending method and found to be Arrhenius with an activation energy of 138 Kcal/mole. These new data were combined with previously reported capillary and rotation data and gave a smooth plot. The complete viscosity data were used to test the best-known viscosity theories but no reasonable fit was found. As a result of this study it was found that the temperature dependence of the viscosity is not controlled by structural effects such as free volume, configuration entropy, etc., but by activation energy effects in the viscous flow process. Finally, all theories are in error in predicting that the viscosity goes to infinity (in the annealing region) much faster than the measured values indicate. Author (TAB)

N69-40810# McGill Univ., Montreal (Quebec). Dept. of Chemistry.
CLUSTERING OF IONS IN ORGANIC POLYMERS: A THEORETICAL APPROACH
Adi Eisenberg 30 Jul. 1969 37 p refs Submitted for publication
(Contract N00014-68-C-0237)
(AD-691456; TR-19) Avail: CFSTI CSCL 11/9

Clustering of ions in organic polymers is treated from a theoretical point of view. It is shown that ions in organic media of low dielectric constant exist most probably as pairs or higher multiplets, even at relatively high temperatures. The maximum size of a non-crystalline and approximately spherical multiplet is shown to be determined by the surface areas and volumes of the participating chemical species and is of the order of 8 ion pairs or less. At relatively low temperatures, the ionic multiplets can aggregate to form a cluster, the factors involved in cluster formation being the elasticity of the chains and the electrical work of cluster collapse. Several simple geometries are assumed for ethylene-sodium methacrylate clusters, and the average inter-cluster distance for 4.5 mol % of the ionic component ranges from 44A to 95A. The experimentally determined repeat distance is of the order of 83A. Author (TAB)

N69-40819# Naval Research Lab., Washington, D.C.
INVESTIGATION OF SOME NEW AMINES AS REGENERATIVE CARBON DIOXIDE ABSORBENTS Final Report
Paul R. Gustafson and R.R. Miller 23 Jul. 1969 20 p refs
(AD-691771; NRL-6926) Avail: CFSTI CSCL 6/11

Three amines-monoethanolamine MEA, 2- 2-aminodethoxy ethanol DGA, and 3-amino-1-propanol MPA -each mixed with one of a series of organic liquids with high CO 2 solubility and varying proportions of H2O, were compared with their corresponding aqueous solutions with regard to CO2 absorption, CO2 stripping, and solution viscosity. The organic liquids were N, N-dimethylformamide, N, N-dimethyl-acetamide, tetramethylene sulfone, N N -methyl-2-pyrrolidinone, hexamethylphosphoric triamide, and tetramethylurea. While some of the organic liquids improved the CO2 absorption and stripping properties of 4N aqueous MEA to a greater extent than did tetramethylene sulfone, the latter solvent, which has better physical properties for use in submarines, increased

the efficiency of 4 N MEA about 20%, and when admixed with 5 N MPA, the improvement was approximately 36%. An omega-aminoalkyl alkyl sulfone, 3- methylsulfonyl propylamine, CH3 SO2 CH2- CH2 NH2, was synethesized and compared with respect to absorption and stripping efficiency, viscosity, oxidation, resistance, foaming, and capacity. A significant improvement over MEA was noted in oxidation resistance, volatility, and stripping efficiency. Although the foaming was excessive, it could be controlled by the use of antifoam agents. Author (TAB)

N69-40822# Fulmer Research Inst., Ltd., Stokes Poges (England).
HEATS OF FORMATION OF LIGHT ELEMENT COMPOUNDS Progress Report, 1 Jan. - 31 Mar. 1969
P. Gross, C. Hayman, R. H. Lewin, and G. C. Curme. 28 Apr. 1969 8 p refs
(Contract AF 61(052)-863)
(AD-691487; R.163/34; PR-16) Avail: CFSTI CSCL 7/4

A summary is given of research on the determination of the heats of formation of iodides by direct reaction of an element with iodine, and the determination of the heat of formation of beryllium boride. Author (TAB)

N69-40838# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
FLASH-SPECTROSCOPIC STUDIES ON ACRIDINES AND ACRIDANES IN THE 300 DEG TO 90 DEG K TEMPERATURE RANGE [BLITZLICHTSPEKTROSKOPISCHE UNTERSUCHUNGEN AN ACRIDINEN UND ACRIDANEN IM TEMPERATURBEREICH 300 DEG K MINUS 90 DEG K]
Gerhart Prell (Ph.D. Thesis) 1969 123 p refs In GERMAN
Avail: CFSTI

A flash-photolysis system was constructed which permits time-resolved photoelectric studies at a wavelength that is variable but fixed at the time of measurement. The system is described in detail. The photoreactions of the acridine cations were studied on the proflavine cation, those of the acridane on the 9-phenyl acridane. The reactions of the 9-CH_3 acridine base were also analyzed. Deactivation, excited states, absorption spectra, formation of radicals, and the effects of temperature on the diffusion-dependent reaction mechanisms were examined. Transl. by K.W.

N69-40841# Technische Hochschule Munchen (West Germany).
STUDIES OF THE REACTION KINETICS ON THE RADICAL ANIONS OF p-NITROBENZOIC ACID AND NITROBENZENE BY MEANS OF ELECTRON SPIN RESONANCE [REAKTIONSKINETISCHE UNTERSUCHUNGEN AN DEN RADIKALANIONEN DER P-NITROBEZOESAEURE UND DES NITROBENZOLS MIT HILFE DER ELEKTRONENSPINRESONANZ]
Dieter Kolb (Ph.D. Thesis) 1969 68 p refs In GERMAN
Avail: CFSTI

Using a previously developed current meter, kinetic studies on radical anions of p-nitrobenzoic acid and nitrobenzene in an aqueous alkaline solution are carried out by means of ESR spectroscopy. The radical anions decompose in a disproportionation reaction, in which the proton activity of the solution is due to various effects on the reduction reaction when pH < 11, while the water yields protons required for the reduction reaction when pH > 11. Due to the positive charge, an increase in the encounter probability follows on the basis of the combined electrostatic repulsion between the radical ions of like charge. A sandwich model is assumed for the transition state, which permits an optimum approach of the nitro groups on the one hand, and which displays a maximum of electrostatic interaction on the other. A linear correlation is established between the second-order rate constants of the radical reduction reaction and oxygen concentration. Calculation of the concentration profile confirms that the resulting exponential concentration curve is explained by a disproportionation reaction due to the oxygen effect rather than by a first-order reduction reaction. Transl. by R.B.

N69-40847# Indiana Univ., Bloomington. Dept. of Chemistry.
CHEMICAL EQUILIBRIA AT HIGH TEMPERATURES AND THE MECHANISM OF VAPORIZATION OF COMPOUNDS Final Report
Ralph L. Seifert. 7 Jul. 1969 29 p refs
(Contract AT(11-1)-505)
(COO-505-15)

Research progress is reported on: determination of the decomposition pressure of NiO by the Knudsen effusion method; feasibility study of a recoil momentum technique to identify molecules evaporating from a surface; and determination of the thermodynamic formation constants of molten metal halides by the electronic commutator method. NSA

N69-40855# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Chemistry and Chemical Engineering.
DIFFUSIONAL PHENOMENA IN FLOWING POLYMER SOLUTIONS. PART 2: EXPERIMENTS IN RESOLUTION DISPERSION IN GEL PERMEATION CHROMATOGRAPHY
A. Ouano and J. A. Biesenberger. 29 Jul. 1969 46 p refs
(Contract N00014-67-A-0130)
(AD-691467; TR-10) Avail: CFSTI CSCL 7/4

A systems approach has been applied to the analysis of chromatogram dispersion, or zone broadening, in Gen Permeation Chromatography (G.P.C.). Three components of a Waters Associates Model 200 chromatograph, each of which is a potential cause of dispersion, were investigated experimentally; these are: the packed column, with extra-particle dispersion only; the empty tubing, between pump and columns, columns and detector, etc., and the detection system, vis., the differential refractometer cell. Author (TAB)

N69-40877# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
ON THE MECHANISM OF CATALYTIC HYDRATION BASED ON INTRAMOLECULAR HYDROGEN ISOTOPE DISTRIBUTIONS AND EFFECTS [ZUM MECHANISMUS DER KATALYTISCHEN HYDRIERUNG AUFGRUND VON INTRAMOLEKULAREN WASSERSTOFF-ISOTOPENVERTEILUNGEN UND-ISOTOPENEFFEKTEN]
Otto Berngruber (Ph.D. Thesis) 1969 107 p refs In GERMAN
Avail: CFSTI

Determined was the intermolecular hydrogen isotope distribution after hydration of non-saturated α,β carbonyl compounds with H_2/HT in the presence of heterogen catalysators (palladium, platin) and a homogeneous catalysator (tris(triphenylphosphine)-chlororhodium). Observation of tritium distribution and isotopic effects showed that the carbon atom carrying the positive substituent exhibited always a low affinity for tritium; metal-hydrogen solution bonds determined the velocity of the catalytic hydration and the maximal isotopic effect. A correlation between pressure mass, activity of the catalysator and the isotope effect was not observed. Transl. by G.G.

N69-40880# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
MASS-SPECTROSCOPIC AND PREPARATIVE CONTRIBUTIONS ON THE CHEMISTRY OF THE METAL PI COMPLEXES [MASSENSPEKTROSKOPISCHE UND PRAEPARATIVE BEITRAEGE ZUR CHEMIE DER METALL-PI-KOMPLEXE]
Peter Goeser (Ph.D. Thesis) 1969 63 p refs In GERMAN
Avail: CFSTI

Mass spectroscopic studies performed centered on transition metal-π-complexes with emphasis on fragmentation processes and determination of ionization and bonding energies in ligands. In general, fragmentation processes differed from the behavior of the free ligands and were mostly determined by the central metal. Fragmentation on transition metal-π-complexes with five, six, and seven linked aromatic ring ligands occurred mainly by successive

separations of ring ligands. Also described were syntheses of some new π-complexes with emphasis on the dibenzo-cyclooctatetraendous complex ligand. Transl. by G.G.

N69-40904# Technische Hochschule Munchen (West Germany).
X-RAY FINE STRUCTURE STUDIES OF THE OXIDATION OF FERROSOFERRIC OXIDE TO GAMMA-FERRIC OXIDE AND ALPHA-FERRIC OXIDE, AND THE REDUCTION OF ALPHA-FERRIC OXIDE TO FERROSOFERRIC OXIDE, FERROUS OXIDE, AND IRON [ROETGENFEINSTRUKTURUNTERSUCHUNG DER OXIDATION VON FE SUB 3 O SUB 4 ZU GAMMA-FE SUB 2 O SUB 3, UND ALPHA-FE SUB 2 O SUB 3, UND DER REDUKTION VON ALPHA-FE SUB 2 O SUB 3 ZU FE SUB 3 O SUB 4, FEO UND FE]
Mehdi Alavi (Ph.D. Thesis) 1969 19 p refs In GERMAN
Avail: CFSTI

The formation of γ-Fe_2O_3 from Fe_3O_4 was radiographically observed in order to locate any existing areas of pure γ-Fe_2O_3. Since the production of γ-Fe_2O_3 required as a first step the production of pure (i.e. free of vacancies) Fe_3O_4, it was necessary to find a simple method for obtaining Fe_3O_4 from α-Fe_2O_3 in a suitable reduction atmosphere while observing at the same time the effects of roasting temperature and duration on the reduction. The study also sought to determine the validity of the Wegard additive law and whether or not the lattice constants change continuously during the oxidation from magnetite to maghemite and broaden the spinel lines in the process. A new method was developed for the reduction in a gaseous mixture of 10% H_2 and 90% N_2. The oxidation of Fe_3O_4 to γ-Fe_2O_3 proceeds over two intermediate phases with spinel structure. Elementary iron and two different FeO phases appear at higher temperatures. Transl. by K.W.

N69-40921# Ohio State Univ. Research Foundation, Columbus. Dept. of Chemistry.
MOLECULAR STRUCTURE OF CARBANIONS AND THE KINETICS OF THEIR EXCHANGE PROCESSES IN SOLUTION Final Report
Gideon Fraenkel 21 May 1969 18 p refs
(Grants AF-AFOSR-251-65; AF-AFOSR-68-1441)
(AD-691854; AFOSR-69-1951TR; Rept-1) Avail: CFSTI CSCL 7/4

The nuclear magnetic resonance (nmr) line-shape technique was used to measure rates of inversion and carbon-metal bond exchange for organometallic compounds in solution. The dominant mechanism is found to involve, in the slow step, carbon bridging in polymeric aggregates. Studies are also reported on the calculation of chemical shifts from molecular wave functions. In qualitative work the chemistry of electrocyclic reactions of carbanions was investigated and a method was developed to generate carbon atoms in solution. Author (TAB)

N69-40926 Duke Univ., Durham, N.C.
ELECTRON SPIN RESONANCE STUDIES OF RADIATION DAMAGE TO SINGLE CRYSTALS OF GUANINE HYDROCHLORIDE
Chester Alexander, Jr. (Ph.D. Thesis) 1968 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-3133

Electron spin resonance techniques were used to study the radical produced by γ-irradiation in single crystals of guanine hydrochloride. Crystals of both the dihydrate and monohydrate forms of guanine hydrochloride were grown and studied. Both X-band and K-band spectrometers were used, and all observations were made at room temperature. A detailed analysis was made of the radical formed in the guanine hydrochloride dihydrate crystal. Hyperconjugative coupling to two hydrogen nuclei was found to be equivalent, giving an isotropic splitting of 36 gauss. Coupling of an unpaired electron to an N^{14} nuclear moment was found to be axially symmetric with principal values A_{11} = 21.0 gauss, observed with the magnetic field perpendicular to the plane of the molecule, and A_1 = 1.5 gauss, observed with the field in the plane of the molecule. The reported crystal structure showed the guanine molecule to be in the form of (H-guanine)$^+$ in the crystal. Dissert. Abstr.

N69-40966 Purdue Univ., Lafayette, Ind.
FORMATION AND DIFFUSION OF POINT DEFECTS IN CALCIUM TITANATE
William Lloyd George (Ph.D. Thesis) 1968 130 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-2922

The electrical conductivity and Seebeck coeficient of single crystal calcium titanate were measured as a function of temperature and P_{H_2O}/P_{H_2}. The electrical conductivity was determined at temperatures from 900°C to 1300°C; thermoelectric data were taken from 1050°C to 1300°C. The sign of the Seebeck coefficient indicated the majority carriers to be electrons. The results may be described by a majority defect model consisting of doubly ionized oxygen vacancies and electrons. The standard enthalpy of formation was found to be 93,000 ± 4000 cal/mole of oxygen vacancies. Diffusion coefficients were determined by analysis of transient electrical conductivity data. The activation energy for motion of oxygen vacancies was found to be 18,000 cal/mole. Dissert. Abstr.

N69-40993# Scientific Translation Service, Ann Arbor, Mich.
CONTRIBUTION TO THE SEPARATION OF RARE EARTHS BY EXTRACTION CHROMATOGRAPHY WITH DI (2-ETHYLEHEXYL) PHOSPHORIC ACID (HDEHP). PART 1: SILICA GEL AS A SUPPORT MATERIAL FOR THE STATIONARY PHASE
Eckhard Herrmann 1968 12 p refs Transl. into ENGLISH from J. Chromatog., no. 38, 17 Dec. 1968 p 498-507 Presented at the Radioanal. Conf., Stary Smokovec, Czechoslovakia, 23-26 Apr. 1968 Sponsored by AEC Prepared for Argonne Natl. Lab., Ill.
(ANL-TRANS-756) Avail: CFSTI

Hydrophobised silica gel was used as support material for extraction chromatographic separations of rare earths with di(2-ethylhexyl) ester of phosphoric acid (HDEHP). Columns with a capacity of 0.8 mequiv. per ml of column and a height equivalent of one theoretical plate of H $\leq$ 0.1 mm for europium and gadolinium were obtained. H is independent of the type of silica gel when its mean pore diameter is $\geq$35 Å and is also nearly independent of the amount of HDEHP used, as long as the silica gel only absorbs the dialkyl ester of phosphoric acid so that a dry powder is produced again after absorption. Examples of separation show the efficiency of the columns obtained. Author (NSA)

N69-41019*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
ESTIMATED GAS COMPOSITIONS IN EQUILIBRIUM WITH CONDENSED PHASES OF THE Cs-O SYSTEM
Leonard K. Tower 22 Oct. 1969 20 p refs
(NASA-TM-X-52702) Avail: CFSTI CSCL 07D

Thermionic energy converters with a single additive reservoir furnishing both cesium and oxygen appear promising. Theoretical estimates were made of the relation between the composition of the vapor above the reservoir at various temperatures and the oxygen concentration of the condensate. For example, at 740 K, an oxygen atom fraction of about 0.13 in the condensate corresponded to a cesium/oxygen ration of about 10^6 in the vapor. The utility of the results is limited by the large uncertainties in the thermal data employed in the analysis. Author

N69-41056# Houston Univ., Tex. Dept. of Chemical and Petroleum Engineering.
LIST STRUCTURES IN ENGINEERING DESIGN

H. Vernon Hough and Rodolphe L. Motard. Mar. 1969. 209 p. refs.
(Contract N00014-68-A-0151)
(AD-691393; RE-2-69) Avail: CFSTI CSCL 7/1

A retrieval system for chemical process network calculations or other engineering system network computations was developed using SLIP and FORTRAN. Facilities for building network-type information structures, and for displaying and altering content or structure are included. No computational interface is provided. Author (TAB)

N69-41075 Fordham Univ., New York.
INVESTIGATIONS OF NON-LINEAR OPTICAL EFFECTS IN ORGANIC LIQUIDS
Ronald Lee Stephens (Ph.D. Thesis). 1968. 166 p.
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00. Order No. 69-2616.

A cryptocyanine Q-switched ruby laser was designed and constructed for use as an excitation source in nonlinear optical experiments. The longitudinal mode structure was controlled by varying the temperature of the ruby crystal. The mode-controlled laser was analyzed for three resonator configurations; a 50 percent reflecting, dielectric coated quartz flat which gave a mode spacing of 0.27 cm^{-1}, a single, 2 mm thick sapphire flat, and a double resonant reflector composed of two such flats with mode spacing of 1.43 and 1.88 cm^{-1} respectively. The laser output was approximately 10 megawatts in a 30 ns pulse with a frequency bandwidth of 0.03 cm^{-1}. This laser was used as a light source to study nonlinear optical effects in organic liquids. Line-broadening in stimulated Raman Stokes scattering caused by the effective multimode excitation due to reamplified stimulated Brillouin scattering was verified in benzene. Dissert. Abstr.

N69-41088# Library of Congress, Washington, D.C. Aerospace Technology Div.
PHOTOCHROMIC SPIROPYRANS FOR OPTICAL MEMORY DEVICES
John G. Kourilo. *In its* Foreign Sci. Bull., vol. 5, No. 9, Sep. 1969, p. 28 - 42. refs. (See N69-41085 24-34)
Avail: Issuing Activity

Soviet research on thermo- and photochromic spiropyrans during the period 1965-68 is reviewed. Research studies on the mechanism of photochromic reactions, practical capabilities and limitations of systems of the benzospiropyran-indoline series in liquid solutions or polymer films, syntehsis, and photochromic efficiency of the new spiropyrans are examined. Methods have been developed for sensitizing photochromic reactions in benzospiropyran-polymer systems by the triplet-triplet energy transfer from aromatic ketone or polymer donors to a spiropyran acceptor. Efforts are outlined to select the most suitable benzospiropyran polymer-solvent combination with respect to use in optical information storage devices. Author

N69-41105# Technische Hochschule Munchen (West Germany).
THE 2,2,2-TRIFLUOR-1-ACYLAMINO ETHYL REST AS A PROTECTIVE GROUP FOR THE THIOL FUNCTION OF THE CYSTEINE IN PEPTIDE SYNTHESES [DER 2,2,2,-TRIFLUOR-1-ACYLAMINO-AETHYL-REST ALS SCHUTZGRUPPE FUER DIE THIOLFUNKTION DES CYSTEINS BEI PEPTIDSYNTHESEN]
Heliane Siebert (Ph.D. Thesis). 1969. 68 p. refs. In GERMAN.
Avail: CFSTI

Application of the trifluoro-1-acylamino ethyl radical as sulfur blocking group for cystein in peptide synthesis is studied. The obtained cystein, bound either to nitrogen or sulfur, is coupled to dipeptides bei using amino acid esters and 1-diethylamino-propine-(1) as condensation media. The protective amino-group is then separated so that the peptide can be built up from the amino-group of the cystein, the 2,2,2,-trifluoro-1-acylamino-ethyl-radical can be separated quantitatively from the sulfur with silver or mercury acetate without racemization. Transl. by G.G.

N69-41124# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.
HETEROGENEOUS CATALYSIS IN LIQUID SYSTEMS. Final Report, 1 Oct. 1962 - 30 Sep. 1968
Robert L. Burwell, Jr. 29 Jul. 1969. 6 p.
(Grant AF-AFOSR-97-63)
(AD-691858; AFOSR-69-1942TR) Avail: CFSTI CSCL 7/4

A summary is presented of research on the catalytic properties of chromia in the hydrogenation of alkenes. TAB

N69-41139# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Physics.
ANISOTROPIC SECONDARY EMISSION AND OTHER DYNAMICAL EFFECTS IN LOW ENERGY ELECTRON DIFFRACTION
Howard H. Taub (Ph.D. Thesis) and Richard M. Stern. Jun. 1969. 153 p. refs.
(Grant AF-AFOSR-1263-67)
(AD-691483; AFOSR-69-1877TR) CSCL 20/2

It is observed that the total secondary electron emission from single crystals depends on the incident direction of the primary electron beam. A dynamical diffraction model is proposed to explain these effects and is applied to other dynamical effects observed in LEED. By means of the reciprocity theorem and Brillouin zone diagrams maxima in the secondary emission are predicted when the incident beam is in a low index direction: the angular width of these maxima are also predicted. Furthermore the theory predicts conditions under which the peaks may vanish, and the existence of maxima which do not correspond to low index directions. It is concluded that the maxima in emission are artifacts resulting from the negative contribution to the secondary emission due to forward diffraction. A formulation in terms of two beam dynamical theory is proposed which qualitatively describes the shift in the position of the dips from the Brillouin zone boundary, and the temperature dependence of the maxima and the minima. From computer calculations based on this model and the best fit with the data, it is concluded that the incident electrons penetrate to the depth of the order of the escape depth for secondary electrons, which is of the order of 20-200 angstroms. The observation of multiple scattering minima in elastic Bragg intensities, different from resonance effects previously described in the literature are described in terms of the excitation of low index reflections. Author (TAB)

N69-41142# Rocket Propulsion Establishment, Westcott (England).
THE HETEROGENEOUS DECOMPOSITION OF HYDRAZIME. PART 1: KINETICS OF THE LIQUID PHASE DECOMPOSITION ON A SUPPORTED IRIDIUM CATALYST
C. F. Sayer. Oct. 1968. 21 p. refs.
(AD-691511; RPE-TR-68-8) Avail: CFSTI CSCL 7/4

The rate of decomposition of hydrazine on a supported iridium catalyst at 22C is a linear function of the concentration of hydrazine over the range 15-100% w/w of hydrazine. The products of the reaction are nitrogen and ammonia and the overall decomposition may be represented by the equation $3N_2H_4 = N_2 + 4NH_3$. The activation energy of the reaction is 15,628 ± 22 cal mole -1 and the frequency factor for 99.% w/w hydrazine is 3.0 × 107 liter gm -1 sec. -1 TAB

N69-41178# Mound Lab., Miamisburg, Ohio.
VACUUM VAPOR DEPOSITION TECHNIQUES
G. V. Nesslage. 20 Jun. 1969. 16 p. refs.
(Contract AT(33-1)-GEN-53)
(MLM-1509) Avail: AEC Depository Libraries

Vacuum deposition techniques including vacuum evaporation, ion plating, and sputtering are reviewed. Basic point and directed surface sources are discussed together with basic mathematics from which theoretical calculations of source performance can be

derived. Illustrations of the vacuum deposition techniques are presented along with a discussion of each technique. Author (NSA)

N69-41206*# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.

A STUDY OF GAS SOLUBILITIES AND TRANSPORT PROPERTIES IN FUEL CELL ELECTROLYTES Semiannual Report, 1 Mar. - 31 Aug. 1968

Robert D. Walker, Jr. 25 Feb. 1969 205 p refs

(Grant NGR-10-005-022)

(NASA-CR-106407; SAR-6) Avail: CFSTI CSCL 07D

Results are discussed for the following measurements: (1) solubility of hydrogen and oxygen over the temperature range 25° to 100° C and the KOH concentration range zero to saturation; (2) solubilities of other roughly spherical modules to test a theoretical model; (3) solubility of hydrogen, oxygen, helium, and argon in LiOH solutions from 25° to 100° C and from zero to saturation; (4) diffusivity of hydrogen and oxygen in KOH solutions over the same ranges of temperature and KOH concentration using a stagnant microelectrode technique; (5) mutual diffusion coefficients at four different temperatures and at KOH concentrations from zero to near saturation; (6) vapor pressure of water over the same temperatures and LiOH concentration using a dew point method; and (7) density of KOH solutions from 60° to 161° C and the concentration range zero to 77.1 wt. percent using a hydrostatic weighing method and a silver plummet. E.C.

N69-41233# Sandia Corp., Albuquerque, N. Mex.

METHOD OF PRODUCING FOILS OF MULBERRY FOR TRANSMISSION ELECTRON MICROSCOPY

Frederick A. Greulich Jun. 1969 16 p refs Sponsored by AEC

(SC-DR-69-185) Avail: CFSTI

Results of a study to determine methods of producing foils of U-7-1/2% Nb-2-1/2% Zr alloy to be used for transmission electron microscopy are presented. Suitable foils were produced by spark cutting and spark planing followed by final thinning in a dual jet thinner using a solution of 6% $HClO_4$ in methanol. A chemical etch-polishing solution consisting of 35 ml HCl, 25 ml H_2O, 5 ml HNO_3, and 1 ml (25 drops) HF was developed for intermediate thinning to replace spark planing for faster preparation of gamma phase material. Author (NSA)

N69-41315# Joint Publications Research Service, Washington, D.C.

STABILIZED ARC AS EXCITATION SOURCE FOR SPECTROCHEMICAL ANALYSIS

M. Marinkovic et al. *In its* Transl. on Eastern Europe Sci. Affairs, No. 56 18 Jun. 1969 p 16-19 refs Transl. into ENGLISH from Jugoslav. Pronalazastvo (Belgrade), Feb. 1969 p 8-9 (See N69-41313 24-24)

Avail: CFSTI

A description is presented of a stabilized electric arc which eliminates many of the shortcomings of previous types. As an excitation source for spectrochemical analysis, the advantages of the arc are its high sensitivity, as well as its potential for solving many analytical problems associated with measurement of a large number of elements in high concentrations and also in traces. A.C.R.

N69-41320 Illinois Univ., Urbana.

DISLOCATION-INTERSTITIAL INTERACTION IN THE NIOBIUM NITROGEN SYSTEM

Charles Curtis Dollins (Ph.D. Thesis) 1968 89 p

Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-1333

The precipitation of nitrogen onto dislocations in deformed niobium was measured using anelastic methods and transmission electron microscopy. The specimens, wires about 1 mm in diameter, were equilibrated with nitrogen at a high temperature and then quickly cooled to produce a homogeneous, supersaturated solid solution. After room temperature deformation, they were aged at temperatures between 300° and 500°C to precipitate the nitrogen onto the dislocations. The nitrogen left solid solution in time dependence given by the expression t^n as measured by the decay of the Snoek peak of nitrogen. Transmission electron microscopy was used to deduce the character of the precipitates. The nature, location, size and habit plane of the precipitates were determined as a function of time. Attention was given to the dislocation distribution and its effect on the kinetics of precipitation. The development and decay of the cold work peak were followed by internal friction measurements and were correlated with the nature of precipitates as seen by electron microscopy. Dissert. Abstr.

N69-41352# California Univ., Berkeley. Lawrence Radiation Lab.

DEVELOPMENT OF A JET-MIXED EXTRACTION COLUMN

Daniel R. Kahn and Theodoro Vermeulen Feb. 1969 88 p refs

(Contract W-7405-ENG-48)

(PB-183636; UCRL-18679) Avail: CFSTI CSCL 07A

A jet-mixed extraction column was developed which incorporates most advantages of existing column-type extractors, while eliminating the need for internal moving parts. The column was designed to provide high rates of mass transfer, with only normal or even decreased extents of unwanted longitudinal dispersion (axial mixing). A guide to some of the more important experimental studies involving longitudinal dispersion in various column-type extractors, and two theoretical models which describe the combined effect of mass transfer and longitudinal dispersion, are presented. The concept of a jet-mixed column is discussed, and the apparatus employed in the present study is described. The column utilizes uniformly spaced, horizontal, tubular, jetting and intake rings at the inner and outer boundaries of an annular cross-section. USGRDR

N69-41357 Virginia Univ., Charlottesville.

A STUDY OF SURFACE CHARGE ON POLYMER ELECTRETS

Robert Andrew Draughn (Ph.D. Thesis) 1968 161 p

Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-18194

A study was made of the effects of various environments on the surface charge of polymer electrets. Variation of the electret forming conditions showed that the specimens studied conform to the accepted two charge theory of electrets. Most electrets were formed by application of a high electric field for 30 seconds in room atmosphere. Electrets so formed exhibited predominant homocharge. Electrets formed in dry air exhibited surface charges of about one-half that of electrets similarly formed in room air, indicating that water is a significant contributor to electret surface charge. Electrets formed in vacuum of 10^{-5} Torr initially exhibited predominant heterocharge. Electrets formed in room atmosphere were exposed to room atmosphere, water, physiological saline, oxygen, nitrogen, helium, and vacuum. Dissert. Abstr.

N69-41364 Rensselaer Polytechnic Inst., Troy, N.Y.

THERMAL CONDUCTIVITY AND HEAT CAPACITY OF SOME AMORPHOUS POLYMERS BELOW 4 DEG K

Chung-Loong Choy (Ph.D. Thesis) 1968 112 p

Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-2453

The thermal conductivity K of three amorphous polymers, polymethyl methacrylate (PMMA), polystyrene (PS) and polyvinyl acetate was measured between 0.4° and 4°K and the heat capacity C of PMMA and PS was measured between 0.6 and 4°K. The thermal conductivity was measured by the steady heat flow method and the heat capacity was measured by both the heat pulse method and thermal diffusivity measurements. The thermal conductivity of all three polymers has similar temperature dependence. It is nearly temperature independent at 4°K and decreases with an ever increasing slope as the temperature is reduced. Between 1.2° and 4°K the thermal conductivity can be fit to Klemens' theory which assumes two parallel scattering mechanisms, the three-phonons

normal scattering and the amorphous "structure scattering." The thermal conductivity has the same temperature dependence but increases slightly with increase in molecular weight. Dissert. Abstr.

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N69-40004# California Univ., Los Angeles. Dept. of Engineering.
ADAPTIVE MULTICHANNEL RECEPTION OF BINARY SIGNALS
Bassim Shawaf (Ph.D. Thesis) 1968 139 p refs
(Grant AF-AFSOR-1408-68)
(AD-691017; AFOSR-69-1821TR) Avail: CFSTI CSCL 9/4

The dissertation considers the optimization problem of adaptive multichannel reception of binary signals which are corrupted multiplicatively by random amplitude parameters with no known a priori distributions, and additively by white Gaussian noise processes of known spectral densities which we allow to be different among the channels. A distinction is made between two modes of operation: multiple processing, in which the unknown amplitude parameters are estimated and used adaptively to adjust weighting factors in a composite decision rule, and based on this, a decision is made within each observation interval; the other, in which the processing is carried out independently at each receiver, arriving at an ultimate decision using majority logic combining. This latter mode is found to yield consistently higher error probability but may be simpler in implementation than the former in that the requirement for estimation is obviated. Author (TAB)

N69-40047# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTIMAL MISMATCHED FILTER DESIGN FOR RADAR RANGING AND RESOLUTION
Robert J. Mc Aulay and John R. Johnson 8 May 1969 29 p refs
(Contract AF 19(628)-5167)
(AD-690994; TN-1969-6; ESD-TR-69-108) Avail: CFSTI CSCL 17/9

In a single-target radar environment, matched filters provide the maximum output signal-to-noise ratio for target detection and yield the minimum mean-squared error estimate of target range. In a multiple-target environment, the sidelobes of the compressed pulse must be considered in the system design because of the likelihood of false alarms. In this case, the signal processor uses weighting filters which are not matched to the transmitted waveform. In this report, expressions for the mean-squared range estimation error, the estimate bias, and the effects of the sidelobes are derived in terms of the impulse response of an arbitrary mismatched filter. We desire to find that impulse response which leads to an unbiased estimate having the minimum range estimate variance subject to preassigned resolution (i.e., sidelobe) contraints. This optimization problem is formulated in state-space in which the optimal control law is sought. Pontryagins maximum principle is used to obtain necessary conditions for the optimum filter. When the sidelobe constraints are neglected, these conditions lead to the matched filter solution. In an attempt to synthesize the optimal filter for the general case, we set up a nonlinear programming problem involving the set of unknown Lagrange multipliers. This should be a computationally easier problem to solve than the original variational problem. An example is given which illustrates the methodology for synthesizing the optimum filter when the class of admissible controls (i.e., filters) is restricted by physical considerations. It is in this case that the real power of the state-space development is clearly demonstrated. Author (TAB)

N69-40075*# Pennsylvania Univ., Philadelphia. The Moore School of Electrical Engineering.
REDUCING MULTIPATH ERROR IN AN ANGLE-MEASURING NAVIGATION SATELLITE SYSTEM Interim Technical Report
Richard A. Hrusovsky Sep. 1969 74 p refs
(Grant NGR-39-010-087)
(NASA-CR-106353; Rept-70-07) Avail: CFSTI CSCL 17B

A signal design method of reducing multipath error is investigated wherein the navigation signals are swept in frequency. A time averaging of the frequency-swept signals at the navigation receiver can then be used to reduce the multipath error contribution below the maximum fixed-frequency error. It was found that for certain critical values of sweep width the multipath error may be completely cancelled and that shifts in these critical sweep width operating points due to user motion during the time interval of integration can be tolerated at the expense of a larger total sweep width. Compared with the integration-while-in-motion method, a greater degree of control in error reduction was indicated with the frequency sweep technique. Author

N69-40095# Rome Air Development Center, Griffiss AFB, N.Y.
TRANSMISSION TECHNIQUE PERFORMANCE AND CHANNEL RELATIONSHIPS IN DATA COMMUNICATIONS
Robert C. Waag Jun. 1969 45 p refs
(AD-690607; RADC-TR-69-204) Avail: CFSTI CSCL 17/2.1

Selected data modem techniques and recently envolved channel characterizations are surveyed and annotations are made for comparative evaluations of data transmission techniques. First, fundamental relations are reviewed and unified with emphasis on their physical interpretations as they apply to technique performances and channel parameters. This is done by describing phenomenologically low-frequency, high-frequency, microwave, and troposcatter radio channels and ascribing, where possible, deterministic and nondeterministic characterizations to them. Parameters giving measures of various important phenomena are inferred from the characterizations and are interpeted physically. Particular attention is given to time- and frequency-selective fading normally observed in high-frequency and troposcatter channels and also observed in microwave or other line-of-sight channels in the presence of objects such as planes moving through the path of transmission. Next, representative data modem techniques are presented and compared for various combinations of channel parameters and levels of implementation complexity. Finally, based on the foregoing review, consideration is given to selected modems both in existence and in development. This is done by describing the distinguishing features of the modems and then, when possible, presenting both predictions and experimental validations. Specific tests that graphically illustrate the importance of time- and frequency-selective fading in modem technique performance are stressed. Author (TAB)

N69-40099*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PULSE-RESPONSE CURVES OF CONVENTIONAL LOW-PASS FILTERS
William D. Stanley (Old Dominion Univ.) and Doris M. Higgins Washington Oct. 1969 116 p refs
(NASA-TN-D-5494) Avail: CFSTI CSCL 17B

A catalog of 100 different pulse responses of conventional low-pass filters is presented. The pulse responses were obtained by a computer simulation of a general digital filter whose characteristics could be varied to correspond very closely with the various analog filter functions. The standard Butterworth, the Chebyshev (with various ripples), and the Bessel filter functions are considered. Filter orders from 1 to 5 are included. For each filter type and order, responses corresponding to four different products of bandwidth and pulse width are considered. Author

N69-40125*# TRW Systems Group, Redondo Beach, Calif.
TELEVISION BROADCAST SATELLITE STUDY Final Report
J. Jansen, P. L. Jordan et al 24 Oct. 1969 546 p refs
(Contract NAS3-9707)
(NASA-CR-72510; TRW-08848-6002-R0-00) Avail: CFSTI CSCL 17B

The report discusses the various technical aspects relevant to development and design of television broadcast satellites and the user equipment for receiving satellite broadcasts. Three satellite configurations are outlined. Parametric cost data versus overall system performance are presented. Potential audiences are identified and benefits to education are discussed. Required development is identified. Author

N69-40128*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RADIATION FROM SLOTS ON CYLINDRICAL BODIES USING GEOMETRICAL THEORY OF DIFFRACTION AND CREEPING WAVE THEORY
Constantine A. Balanis (Ph.D. Thesis - Ohio State Univ.) 1969 117 p refs
(NASA-TM-X-61904) Avail: CFSTI CSCL 09F

A hybrid solution employing wedge diffraction and creeping wave theory is used to compute the principal planes (equatorial and elevation) radiation patterns of axial and circumferential slots on conducting cylinders of finite and infinite lengths. The slots are excited by parallel-plate waveguides operating in the TEM and TE_{10} modes. The method is checked computationally by comparison with the modal solutions for axial and circumferential slots on right circular cylinders and experimentally for elliptical cylinders since modal solutions are not readily available. Computed results using this technique compare favorably with those obtained from existing modal expansion boundary-value solutions and experimental results. Author

N69-40135# Boeing Co., Renton, Wash. Commercial Airplane Div.
DATA TRANSMISSION LINK ANALYSIS
T. J. Paull and E. Sestak 21 Jul. 1969 69 p refs
(AD-691877; D6-23848) Avail: CFSTI CSCL 17/2

The problems associated with selecting a sampling rate, a coding format, a modulation technique and a means of providing bit, word, and frame synchronization are discussed for digital data transmission on an SST. Alternate techniques are considered and traded-off in terms of minimizing signal-to-noise requirements, probability of true and false sync, and ease of implementation. The results are dependent on the accuracy requirements, input characteristics, and means of interpolation of data. For the given data requirements and characteristics, the following recommendations are made: frame rate = 90 frames per second; discriminator FSK as the modulation technique; a hybrid sync technique; and a 33 bit frame sync word. Author (TAB)

N69-40136# Naval Research Lab., Washington, D.C.
A TEN-HORN DUAL FREQUENCY MONOPULSE FEED FOR THE 150-FOOT RANDLE CLIFF RADAR ANTENNA Final Report
William L. Thrift Apr. 1969 55 p refs
(AD-690862; NRL-MR-2003) Avail: CFSTI CSCL 17/9

A ten-horn dual-frequency feed was designed for the 150-foot parabolic antenna of NRLs Randle Cliff Radar. The feed has elevation and azimuth monopulse at 141 MHz and 435 MHz, will transmit 5 kilowatts average and 0.5 megawatts peak power at UHF, and 50 kilowatts average and 5 megawatts peak power at VHF, and uses separate elements for the sum and difference modes. For both frequencies the transmit polarization options are right-hand circular or +45-degree slant linear, and the error horn polarization is linear. The transmit horn will receive left-hand and right-hand circular when right-hand circular is transmitted, and -45-degree and +45-degree slant linear when +45-degree slant linear is transmitted. The feed currently being used in the system has monopulse only at VHF, can transmit only vertical polarization at UHF, and uses the same elements for the sum and difference modes. The design tests were performed on a model of the feed reduced in size by a factor of 3.58. The characteristics measured on the model included VSWR, isolation between transmit horns, isolation between transmit and arror horns, E and H-plane primary patterns, and E and H-plane phase centers. The full scale feed has been built and the UHF system matched prior to installation in the reflector. Because of the greater interaction with the support booms, the VHF system will be matched after the feed is mounted in the reflector. The added features of the new feed will provide new possibilities for missile and space Research. Author (TAB)

N69-40140# Arizona Univ., Tucson.
THE SINGULAR INTEGRAL ASSOCIATED WITH A CLASS OF UNIFORMLY PROPAGATIVE SYSTEMS
John R. Schulenberger Jul. 1969 40 p refs
(Contract N0014-67-A-0209-006)
(AD-690614; ONR-TSR-1) Avail: CFSTI CSCL 20/14

The theory of uniformly propagative systems of partial differential equations originated as a means of giving a unified treatment of wave propagation in a broad class of homogeneous, anisotropic media. In some cases the Greens matrix for the system is not given by a locally integrable function. In the paper the correspondence between the Greens matrix for such systems and a closely related singular integral operator is established. This relation is of central importance, since it must be observed in order to interpret the results of the general theory in the classical setting, from which the theory arose, and also in order to obtain the correct system of integral equations for perturbed systems. In addition, this relation gives new insight into certain results of the uniformly propagative theory. As an application, the well-known classical expressions for solutions of Maxwells equations in terms of integrals over current densities are derived. TAB

N69-40175# RAND Corp., Santa Monica, Calif.
CABLE TELEVISION AND SATELLITES
Nathaniel E. Feldman Aug. 1969 11 p
(AD-691869; D-4171) Avail: CFSTI CSCL 17/2

The article extrapolates cable TV toward the limits of what is being proposed as its role--and then explores some implications of the resulting system. Author (TAB)

N69-40193# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FEASIBILITY OF LOW DATA RATE MOBILE TROPOSCATTER COMMUNICATION SYSTEMS
David P. White 30 Apr. 1969 61 p refs
(Contract AF 19(628)-5167)
(AD-690995; TN-1969-15; ESD-TR-69-77) Avail: CFSTI CSCL 17/2.1

For a communications system with a low data rate requirement (i.e., 1 - 1000 bits/sec) one can use troposcatter links over a range interval beyond the distances commonly used. The range is limited by the requirement that the tropopause layer is to be included in the common volume of the beams. This effectively limits the range in most cases to about 450 miles. It is proposed to use frequencies in the interval 3 to 5 GHz. This enables one to specify a completely mobile troposcatter system since the antenna paraboloids have diameters of the order of 10 feet and the power requirement is a modest 10 kW. Author (TAB)

N69-40208 Purdue Univ., Lafayette, Ind.
ANALYSIS AND MINIMIZATION OF MESSAGE ERROR IN PCM TELEMETRY
Aelred Joseph Kurtenbach (Ph.D. Thesis) 1968 189 p refs
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No 69-2942

Transmission of telemetry data is a significant application

of pulse code modulation (PCM) communication systems. For analog data it is necessary for the system to sample, quantize and code the data before transmission over a digital channel. At the destination a facsimile of the source waveform is reconstructed by the receiver. It differs from the source waveform because of error introduced by the sampler, quantizer, and the noisy channel. To evaluate the effect of these errors on the reconstructed waveform the mean-integral-square error criterion was used. The purpose is to minimize this error between sample functions of stationary, second order processes and their facsimiles presented to the user. A conventional PCM telemetry system which utilizes time samples, no data compression, and includes a noisy channel is simulated. In this manner an estimate of its overall performance is obtained. Both the system using a K-L sampler and that using a time sampler followed by a digital filter are found to be superior to the conventional system. Dissert. Abstr.

N69-40214# European Space Vehicle Launcher Development Organization, Paris (France).
EVALUATION OF DEVELOPMENT COSTS AND POSSIBILITIES OF DIRECT TELEVISION SATELLITES [ABSCHAETZUNG DER BESCHAFFUNGSKOSTEN UND-MOEGLICHKEITEN IM RAUMFAHRTSEKTOR BEIM SATEL-LITEN-DIREKT-FERNSEHEN]
Paul Kotowski Sep. 1969 11 p refs In GERMAN Presented at the Colloq. on Direct Satellite Broadcasting, Hamburg, 9-10 Sep. 1969
(ELDO-Publ-23) Avail: CFSTI

This report discusses possibilities and cost estimates of a direct television space broadcast system for Europe. It compares the costs of American systems with possible European systems and also considers the development of suitable European launchers and a possible European development programme. ESRO

N69-40221# Rome Air Development Center, Griffiss AFB, N.Y.
MEASURED PERFORMANCE OF HF SUBSURFACE DIPOLES
John N. Entzminger, Jr., Thomas F. Treadway, and Stuart H. Talbot Jun. 1969 140 p refs
(AD-690609; RADC-TR-69-221) Avail: CFSTI CSCL 17/2.1

Theoretical analysis and measured data are presented for determining the characteristics of High Frequency (HF) subsurface dipole antennas. The agreement between theory and experimental data is shown to be excellent. It is shown that HF subsurface dipoles radiate a surface wave having the same characteristics as that launched by an above ground vertical monopole and also radiate a space wave which has a pattern identical to that of a half wave horizontal dipole located a quarter wavelength or less above ground. The subsurface dipole length is shortened to about one-third to two-thirds of its above ground equivalent. Engineering curves are presented which enable the system engineer to design a small, physically hard, relatively cheap HF antenna array having a gain of approximately -10 db below that of simple above ground antennas, and having the radiation characteristics of both above ground whip and horizontal dipole antennas. Author (TAB)

N69-40223# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Aerospace Medical Div.
TARGET DETECTION AND RECOGNITION ON SINGLE VERSUS DUAL SENSOR DISPLAYS OF INFRARED AND SIDE LOOKING RADAR
James L. Porterfield and Almon J. Bate Feb. 1969 44 p
(AD-690603; AMRL-TR-68-127) Avail: CFSTI CSCL 5/8

The study was primarily designed to compare single versus dual-sensor displays on the basis of observer target detection and recognition performance. Strip imagery from downward-looking infrared (IR) and side-looking radar (SLR) of the same ground path was dynamically displayed to three 12-man groups of Strategic Air Command radar observers. One group viewed only the IR display, a second group viewed only the SLR display, and the third group viewed both displays simultaneously. The observers were asked to find and identify airfields, freeway cloverleaves, railroad yards, tank farms, and power transmission lines, on the 11 by 11-inch displays. The imagery was displayed at a scale of 1:23,700 (1 inch = 1/3 mile) and at a simulated ground speed of 300 knots. The observers were scored on the number of targets detected, the number of nontargets they called targets, and the screen distance objects traveled before being responded to. Author (TAB)

N69-40282 Polytechnic Inst. of Brooklyn, N.Y.
OPTIMUM FREQUENCY MODULATION RECEIVERS
Allan Abraham Guida (Ph.D. Thesis) 1968 131 p
Avail: Univ. Microfilms HC $6.40/Microfilm $3.00 Order No. 68-16246

The maximum likelihood equation for demodulating an FM signal corrupted by additive Gaussian noise is derived and examined. Asymptotic formulae for the signal-to-noise ratio of the maximum likelihood estimate are calculated for high carrier-to-noise ratio and infinite observation time. The results show that the FM discriminator is approximately equivalent to the maximum likelihood estimator at high carrier-to-noise ratios. An iterative method for solving the maximum likelihood equation at any carrier-to-noise ratio is presented. It is noted that the difference between optimum FM receivers and non-optimum FM receivers lies mainly in the number of spikes per second present in the output of these receivers. The problem of spike detection is considered and a spike detector is designed for an FM discriminator. Computer results on the capability of the spike detector are presented. Two simple FM receivers are analyzed using appropriate autocorrelation functions and spectral densities. The results are compared to the FM discriminator. Dissert. Abstr.

N69-40293 National Lending Library for Science and Technology, Boston Spa (England).
TRENDS IN THE LAYOUT OF SOUND-CONTROL INSTALLATIONS (AK3 SPECIFICATION) [TENDENZEN IN DER AUSLEGUNG VON TONREGIEANLAGEN]
Von Hans Kersten 20 Jul. 1969 23 p Transl. into ENGLISH from Rundfunk-Tech. Mitt. (Ger.), v. 12, no. 5, 1968 p 226-234 In ENGLISH and GERMAN
(NLL-M-7738-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The several components of a program are mixed in the sound-control installation, and the composite sound picture is produced by filtering changes in the dynamic range, addition of echo and the like. Two main types, which may be distinguished by their level specification, exist side by side: the intermediate levels throughout the chain are either at the input all raised to the output level (standard level), or they are initially raised to a level about 20 dB below the standard level, in which case additional amplification is needed for auxiliary outputs. Discussed is the relationship between the electrical and constructional features and the advantages and disadvantages of the two main types; a brief description is given of a type developed in the Institut fur Rundfunktechnik, having a low intermediate level and concentration of the operational facilities and amplifiers. Author

N69-40391*# Philco-Ford Corp., Newport Beach, Calif. Aeronutronic Div.
MODIFICATION OF 16.5 GHz SIDE-LOOKING RADAR SYSTEM FOR NASA C-130 AIRCRAFT Final Report
R. E. McCain 30 Sep. 1969 20 p
(Contract NAS9-9116)
(NASA-CR-101746; Publ-U-4710) Avail: CFSTI CSCL 17I

Technical details are given on the modifications made to the side-looking radar designed for installation in a C-130 aircraft in support of the NASA Earth Resources Program. The delivered radar system consists of a modified AN/DPD-2 radar electronic assembly, multiple polarized antenna, control panel, and antenna pressurization system. Special test equipment in the form of a system preflight calibrator and recorder calibrator was fabricated and

delivered to support the alignment, checkout, and calibration of the radar system. In addition, component and assembly spares were procured, fabricated, and delivered to support the radar system during the flight test program. Author

N69-40409# RAND Corp., Santa Monica, Calif.
THE PROMISE OF UHF SATELLITES FOR MOBILE SERVICES
John L. Hult Aug. 1969 5 p refs
(AD-691868; P-4170) Avail: CFSTI CSCL 17/2.1

The paper outlines some important factors in spectrum use and conservation, satellite relay systems, and service applications to positioning, communicating and broadcasting. A spectrum partitioning and shared use is developed that would provide unparalleled service opportunities, and an appeal is made for coordinated development to reap a full measure of the benefits potentially available. Author (TAB)

N69-40474# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PRELIMINARY ANALYSIS OF ELF NOISE
James E. Evans 26 Mar. 1969 58 p refs
(Contract AF 19(628)-5167)
(AD-691814; ESD-TR-69-67; TN-1969-18) Avail: CFSTI CSCL 20/14

Preliminary results of analyzing extremely low frequency (ELF) electromagnetic noise recorded in Florida and Malta are presented. The results include wideband waveforms, power density spectra, amplitude probability distributions and probability distributions for the duration of the interval between noise bursts. The distinctly non-Gaussian nature of the noise is demonstrated in a variety of ways. Author (TAB)

N69-40533# Electro-Voice, Inc., Buchanan, Mich.
HANDSET H-294[#]/U Quarterly Report, 28 Feb. - 30 Apr. 1969
B. T. Cochran and A. Bennett Ft. Monmouth, N.J. ECOM Jun. 1969 15 p
(Contract DAAB07-69-C-0173)
(AD-690849; ECOM-0173-1; QR-1) Avail: CFSTI CSCL 17/2.1

This report contains a summary of the work performed for the design and fabrication of a noise cancelling Handset H-294( )/U. During this period the methods of cable termination, and microphone transducer design have been determined. An estimate of the total weight of the handset has also been made. Author (TAB)

N69-40535# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A SELF-TUNING CIRCUIT FOR RECEIVING BINARY SIGNALS UNDER NOISE CONDITIONS WITH UNKNOWN STATISTICAL CHARACTERISTICS
A. N. Klumov et al. 2 Jun. 1969 13 p refs Transl. into ENGLISH from Inst. Avtomatiki i Telemekhan., Samoobuchavushchiyesya Avtomat. Sistemy (Moscow), 1966 p 402 - 407
(AD-692154; FTD-HT-23-112-68) Avail: CFSTI CSCL 9/4

The criterion of minimum average loss of information is applied to an information transfer system. A wideband system for transferring information in binary code is considered and it is assumed that the probability of transmission of each of two possible meanings of a signal is predetermined. A system is dealt with which utilizes a threshold device and whose self-tuning process consists of the following operations. (1) Accumulation of information regarding noise and the state of the system. (2) Computation of the efficiency factor. (3) Determination of the direction and magnitude of the shift in threshold level and (4) Establishment of the new threshold value. An algorithm for the operation of the receiver section is presented in a logic form which has been verified on an analog computer under conditions of additive noise of unknown statistical nature. TAB

N69-40542# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
SIGNAL DESIGN FOR THE NONCOHERENT GAUSSIAN CHANNEL Interim Technical Report
Marvin S. Stone Jul. 1969 89 p refs
(Grants DA-ARO(D)-31-124-G929; DA-ARO(D)-31-124-G1045; NSF GU-1559)
(AD-691781; USCEE-345; AROD-7198.11-RT) Avail: CFSTI CSCL 9/4

A fundamental problem in communication theory is the design of M-ary communication systems. Our concern here is with the signal design portion of the problem for the noncoherent additive white Gaussian noise channel. The signalling waveforms under consideration will consist of M equiprobable, equipowered narrow-band waveforms of equal time duration. We begin by presenting the mathematical model for the noncoherent communication system and then show how the probability of error varies with signal-to-noise ratio and the signal waveform inner product matrix. We then derive a high signal-to-noise ratios approximation to the error probability. Using the aforementioned expression, we show that the noncoherent orthogonal signal structure globally minimizes the probability of error at large signal-to-noise ratios when the dimensionality of the signal set is unrestricted. We then consider the dimensionality constrained signal design problem. The problem of finding optimal signal sets of given dimension is formulated as a variational one. This leads to a necessary condition that must be satisfied so as to locally extremize the error probability. Author (TAB)

N69-40547# DBA Systems, Inc., Melbourne, Fla.
SAGA, A COMPUTER PROGRAM FOR SHORT ARC GEODETIC ADJUSTMENT OF SATELLITE OBSERVATIONS Final Report, Sep. 1967 - Feb. 1969
Duane C. Brown and Jerry E. Trotter Bedford, Mass. AFCRL 17 Feb. 1969 206 p refs
(Contract F19628-68-C-0093)
(AD-691835; AFCRL-69-0080) Avail: CFSTI CSCL 17/8

The development of the Short Arc Geodetic Adjustment (SAGA) program is outlined in detail. The application of the computer program with actual data illustrates the capabilities of the SAGA geodetic positioning. Complete instructions to the program user are included in the report. Author (TAB)

N69-40554 Purdue Univ., Lafayette, Ind.
PERFORMANCE OF SELF BIT SYNCHRONIZERS FOR THE DETECTION OF ANTICORRELATED BINARY SIGNALS
Edgar Jacob Luecke (Ph.D. Thesis) 1968 153 p refs
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-2951

In a digital communication system, it is necessary to properly synchronize the receiver time base so that the digital time symbols can be properly detected. This research is concerned with optimum and suboptimum ways of providing self synchronization for binary anticorrelated signaling. Expected absolute error, as determined from the probability density function of synchronizing error, is used as the performance measure when no detector is specified. Degradation of effective signal to noise ratio is used as the performance measure for operation with a correlation detector. Dissert. Abstr.

N69-40582# Naval Submarine Medical Center, Groton, Conn. Medical Research Lab.
SPEECH INTELLIGIBILITY IN A STATIONARY MULTIPATH CHANNEL Interim Report
Murray B. Sachs, Gary J. O'Brien, Russell L. Sergeant, and Joseph S. Russotti 21 Mar. 1969 11 p refs
(AD-691421; SMRL-574) Avail: CFSTI CSCL 17/2

The reception of speech transmitted through an acoustic channel such as the ocean is limited by multipath time-smearing. The purpose of this study was to obtain a quantitative measure

of the effects of such time-smearing on speech intelligibility. A linear, time-invariant channel was used as a model of the ocean. The impulse response of this channel was a sample of band-limited Gaussian noise. Using Fast Fourier Transform techniques, words of the Modified Rhyme Test were convolved with, or smeared in the time domain, by this channel impulse response. The intelligibility of these smeared words was measured as a function of the impulse response duration, T. Intelligibility decreased monotonically to about 75 percent as T increased to 200 milleseconds. Further increase in T did not significantly lower intelligibility. Distortions in time evaluated herein did not impose serious limitations to the reception of short words. However, a detailed analysis of consonantal errors revealed that sounds occurring in the middle of a word are much harder to hear correctly than are sounds at the beginning or end of an utterance. We conclude that time-smearing will more seriously interfere with the intelligibility of connected or conversational speech. Author (TAB)

N69-40623# Cutler Hammer, Inc., Deer Park, N.Y. AIL Div.
SEAL SYSTEM INTEGRATION Final Report, Jan. 1967–Nov. 1968
J. A. Lovell and B. Gold. Jun. 1969. 125 p. refs
(Contract FA-67-WA-1654)
(AD-691720; SRDS-RD-69-6) Avail: CFSTI CSCL 17/7

The purpose of the work performed was to integrate several developmental equipments into a feasibility model of the system, install it in an aircraft, assist in its flight test at NAFEC (National Aviation Facility Experimental Center), and reduce and report upon the flight test data. Author (TAB)

N69-40709# Decca Navigator Co., Ltd., London (England).
AUTOMATIC AIR-GROUND COMMUNICATIONS BY DIGITAL DATA LINK
C. L. Hynam. *In* Brit. Air Line Pilots Assoc. Automation, Simulation and Data Handling in Civil Aviation. 1968 p 102–108 (See N69-40702 24-02)
Avail: CFSTI

The general problem of data handling over air–ground communication channels is discussed, emphasizing the great need for reducing workloads for both pilots and controllers. It is felt that greater use of secondary surveillance radar will alleviate the immediate problems of channel congestion to some extent, but changes in data handling techniques must be initiated in the future if air transport operations hope to maintain their present rate of growth. The use of digital techniques to replace conventional voice communication is suggested as the probable approach to solving such congestion, and an ATC-oriented data link whose prototype airborne units have been in operational use for four years is described. The system was designed to serve two major functions: (1) data acquisition by automatic interpretation of sensors; and (2) automatic communication by exchange of routine messages between pilot and controller. Advantages accrued from high speed digital communication techniques, as well as the design and operation of the system are treated. A.C.R.

N69-40712# British Overseas Airways Corp., London (England).
THE SCOPE OF COMPUTERS IN AN AIR LINE
A. Jacobs. *In* Brit. Air Line Pilots Assoc. Automation, Simulation and Data Handling in Civil Aviation. 1968 p 146–151 (See N69-40702 24-02)
Avail: CFSTI

An airline information handling system is described which performs four main functions: (1) responsibility for all computer activity; (2) control of worldwide ground-to-ground and air-to-ground communications; (3) office and management services; and (4) statistical services. Four nodal points at various geographical locations are used for routing messages from one switching circuit to another, resulting in significant reduction of transit times and improvement in accuracy. Real-time computer operation for processing passenger reservations and check-in, as well as for aircraft loading and control of cargo movements, is presently available. Future intentions for real-time application include engineering maintenance work, fare construction, and teleticketing at major offices. To achieve the most effective system, three IBM computers are located at a central site and are linked by a network of high-grade communication lines to other main offices which are equipped with modified keyboards and television screens for fast input and response. Other computer equipment is used to control the flow of messages on the communication lines and for local processing jobs, but it is under the control of the central facility. A.C.R.

N69-40805# European Space Research and Technology Center, Noordwijk (Netherlands).
THE HEOS-1 TELECOMMUNICATION SYSTEM
G. Block. *In* ESRO ESRO/ELDO Bull., Suppl.: HEOS-1 Aug. 1969 p 31–36 (See N69-40801 24-31)
Avail: CFSTI

The telecommunication system used on the HEOS-1 satellite, which includes the telemetry subsystem with PCM/PSK/PM telemetry, the telecommand subsystem and the range tone tracking system, are described. ESRO

N69-40902# Ohio State Univ., Columbus. Electroscience Lab.
TIME DOMAIN SIGNATURE MEASUREMENT TECHNIQUES
Jonathan D. Young, David L. Moffatt, and Edward M. Kennaugh. 30 Jul. 1969. 59 p. refs
(Contract F44620-67-C-0095)
(AD-691460; OSURF-2467-3; SR-2; AFCRL-69-0202) Avail: CFSTI CSCL 17/9

Progress toward the experimental measurement of real, time-dependent radar signatures of an object is described. The concept of the radar signature of an object as a characteristic response in time is briefly reviewed and illustrated. Possible approaches to the problem of experimental measurement of these signatures are discussed, and the reasons for our selection of a discrete frequency sampling technique enumerated. A chronological review of the reflectivity systems utilized for target signature measurements is given together with sample data to illustrate the capabilities and limitations of the systems. Finally, an advanced multi-frequency system is suggested and the envisioned orderly evolution of such a system described. Author (TAB)

N69-40982# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
FARADAY ROTATION CONCEPTS IN HOMOGENEOUS ANISTROPIC MEDIA USING THE ROOTS OF THE BOOKER QUARTIC Final Report
Myung Ki Lee. 15 Jul. 1969. 106 p. refs
(Contract DAAD05-69-C-0336; Grant NSF 6P-5611)
(AD-691338; SR-337) Avail: CFSTI CSCL 20/14

A theoretical investigation is made of a possible method for calculating the apparent Faraday rotation of high frequency electromagnetic waves in a generalized ionosphere (anisotropic, including collisions). The method depends on the assumption that the W. K. B. solutions of the wave equations are valid. In the cases where this may not be entirely correct, a refinement in the approach is suggested. This is the addition of reflections at stratified layers which are commonly used to approximate a variable ionosphere that changes in the vertical direction only. The roots of the Booker quartic are used throughout this work in order to produce a generalized scheme for describing apparent Faraday rotation of plane waves in horizontal planes parallel to the assumed stratifications of the ionosphere. This procedure does not yield a direct relationship between electron density and Faraday rotation rate as is commonly used. The assumption is made that closed form equations are not necessary, since computer computation using iterative techniques are readily available. The analytical approach suggested here should lead to a test of accuracy of more simplified

methods such as those that assume line of sight propagation and the validity of the longitudinal approximation to the refractive index calculations. Author (TAB)

N69-41129# Air Force Cambridge Research Labs., Bedford, Mass.
EXTREMELY LOW FREQUENCY NOISE
Charles Polk (Rhode Island Univ., Kingston) and Herbert Koenig (Tech. Univ., Munich) *In its* Geophys. and Space Data Bull., vol. 6, no. 1 1969 p 49 - 58 refs (See N69-41126 24-13)
Avail: CFSTI

The instrumentation and observation methods used to measure extremely low frequency electromagnetic noise in the ionospheric cavity resonance region are described for sites located at Kingston, Rhode Island and Brannenburg, Germany. A discussion of tabulation in the 8-Hz intensity region is also included for both stations. A.C.R.

N69-41167*# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
TELEVISION BROADCAST SATELLITE (TVBS) STUDY, VOLUME 3
R. W. Hesselbacher 15 Nov. 1969 360 p
(Contract NAS3-9708)
(NASA-CR-72579) Avail: CFSTI CSCL 17B

This report presents the results of a study of technological and cost factors associated with TV broadcast satellite systems. The cost and performance of the ground and space segments of the system are evaluated as a function of varying the parameters of transmission frequency, modulation, TV picture quality, audience size, size of coverage areas, indigenous noise, and ground receiving modification costs. Satellite conceptual designs are described based upon technology estimates for the early 1970's. Cost comparisons are made with terrestrial methods of delivering transmissions. Significant broadcast satellite technology items are identified and ranked in order of importance, and the following conclusions are made: broadcast satellites are feasible, cost effective, and capable of achieving turnkey operations sooner than terrestrial systems. Author

N69-41194# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
AN AGAR AGAR CHAMBER FOR THE STUDY OF ELECTROMAGNETIC WAVES IN AN INHOMOGENEOUS MEDIUM, PART 2
Keigo Iizuka Apr. 1969 66 p refs
(Contract N00014-67-A-0298)
(AD-691381; TR-586) Avail: CFSTI CSCL 20/14

A detailed description of techniques developed to control and measure the inhomogeneity of the electrical properties of agar agar was reported in AD-676 914. The actual application of these techniques to the construction of the medium on a large scale is now presented along with the measured results of the circuit and radiation properties of dipoles in such a medium. Author (TAB)

N69-41339# Stanford Univ., Calif. Stanford Electronics Labs.
AN EFFECT OF A TRANSMITTER FREQUENCY INCREASE ON THE OCCURRENCE OF VLF NOISE TRIGGERED NEAR L EQUALS 3 IN THE MAGNETOSPHERE
D. L. Carpenter and S. Lasch Rept. from J. Geophys. Res., Space Phys., v. 74, no. 7, 1 Apr. 1969 p 1859 - 1863 refs
(Contract AF-AFOSR-783-67A)
(AD-691576; AFOSR-69-1874TR) Avail: CFSTI CSCL 17/2.1

The report concerns the influence of transmitter frequency on the production in the magnetosphere of artificially stimulated VLF emissions (ASE). The VLF transmitter involved is NAA, which nominally radiates 1,000,000 watts and is located at Cutler, Maine, at a geomagnetic latitude of 56 deg and L = 3.2. The observations of ASE were made during the austral winters of 1963 and 1965 at Eights, Antarctica, roughly conjugate to NAA at L = 4. It was found that the number of observations of NAA-produced magnetospheric noise decreased markedly when the transmitter frequency was raised from 14.7 kHz to 18.6 kHz in early August 1963 and that when observations were made in 1965 with the transmitter at 17.8 kHz, the occurrence rate of ASE continued to be low. Properties of the distribution of energetic electrons near L = 3 are probably involved in this phenomenon. The inferred decrease in triggering path radius associated with the increase in NAA frequency may have occurred in a region of pronounced spatial and temporal variations of the 1-10 kev electrons capable of resonant interactions with the transmitted waves. Author (TAB)

N69-41384# Sandia Corp., Albuquerque, N. Mex.
BACKSCATTERING FROM THE ROUGH SURFACE OF A SPHERE ILLUMINATED BY A MOVING SOURCE
R. E. Jones and C. W. Harrison, Jr. 21 Feb. 1969 28 p
(PB-183637) Avail: CFSTI CSCL 17I

The objective of the study was to determine the incoherent power scattered from the rough surface of a sphere available at the source at a specified time. It was assumed that the electromagnetic waves are launched and collected by the same directive antenna. The received power depends on many factors including the scattering cross section per unit area of the sphere and the area illuminated. The area illuminated was determined by the intersection of the sphere with a volume of space that is a function of the radar pulse width and the time of interest. Author (USGRDR)

N69-41390 California Inst. of Tech., Pasadena.
ON THE SIGNAL SELECTION PROBLEM FOR PHASE COHERENT AND INCOHERENT COMMUNICATION CHANNELS
Steven Mark Farber (Ph.D. Thesis) 1968 56 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-501

Landau and Slepian have recently obtained a lower bound for the probability of error for any equienergy signal set in the infinite band Gaussian, additive noise channel. They further claim that the regular simplex signal set achieves equality in their lower bound and thereby proves the optimality of this set. In the following paper it is proven that the simplex signals achieve equality in the lower bound of Landau and Slepian only when the dimension n is less than or equal to three. There is also shown to be an equivalence between certain optimal signal sets for the phase coherent channel described by Landau and Slepian and certain optimal signal sets for the incoherent case which have been recently discovered by Schaffner and Krieger. Dissert. Abstr.

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N69-40022# Illinois Univ., Urbana. Dept. of Computer Science.
THE PAX 2 PICTURE PROCESSING SYSTEM AT THE UNIVERSITY OF ILLINOIS PROGRAMMING MANUAL
Richard T. Borovec 18 Mar. 1969 107 p
(COO-1018-1174) Avail: CFSTI

PAX II, a collection of subroutines in FORTRAN for processing pictorial information, is presented. This is a revised and expanded version of PAX which stimulates the pattern articulation unit of the ILLIAC III computer which can perform operations in parallel on digitized pictures stored in two-dimensional registers. PAX II has been implemented on the IBM 7094, IBM 360, and Univac 1108 computers. NSA

N69-40124*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A FRAMEWORK FOR FUTURE DATA CENTERS

James A. Fava. Sep. 1969. 15 p. refs. Presented at the ASIS 32nd Ann. Conv., San Francisco, 1 - 4 Oct. 1969
(X-601-69-415)
(NASA-TM-X-63712) Avail: CFSTI CSCL 09B

A discipline-oriented data center is an essential element for many segments of the scientific community. To be effective, the center must have: (1) professional staffs in the disciplines associated with the center and in the ADP fields, (2) sufficient equipment and software to reformat and change the form of data, and (3) an information retrieval system concerning its holdings. A variety of services must be performed by the center. Most data should be made available to all users, and the paper suggests that all data centers should charge for their output services. Author

N69-40154# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
REPRESENTATION OF THREE DIMENSIONAL SURFACES IN PERSPECTIVE BY COMPUTER [REPRESENTATION EN PERSPECTIVE DE SURFACES A TROIS DIMENSIONS PAR ORDINATEUR]
Gilles Zwingelstein. Jun. 1969. 51 p. refs. In FRENCH; ENGLISH summary
(CEA-R-3819) Avail: CFSTI

An attempt was made to represent a three-dimensional surface by using a computer. The transformation to perspective was obtained with an appropriate calculation algorithm and the surfaces were materialized, according to requirements, either on a digital tracer or on a console for conversational visualization coupled to the computer. Calculation methods for representing the surfaces with or without their hidden lines are given. Author (ESRO)

N69-40160# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE UM-1 CONTROL COMPUTER
A. P. Tsaritsanskiy et al. 22 May 1969. 6 p. Transl. into ENGLISH from Pribory i Sistemy Upravleniya (Moscow), no. 6, 1968 p. 34 - 35
(AD-692158; FTD-HT-23-98-69) Avail: CFSTI CSCL 9/2

The UM-1 digital control computer is intended not only for process control but also as a scientific research tool. It automatically controls technical process parameters according to a prescribed regime providing indication and recording of different process quantities as well as signalization of parameter divergence beyond certain bounds. Author (TAB)

N69-40162# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ESTIMATING NUMERICAL PARAMETERS BY INFORMATION OF THE "SPECIALIST'S KNOWLEDGE" TYPE
E. M. Kussul. 6 Jun. 1969. 14 p. refs. Transl. into ENGLISH from Kibern. (USSR), issue 1, 1967 p. 96 - 100
(AD-692152; FTD-HT-23-1044-68) Avail: CFSTI CSCL 9/2

Various engineering problems (e.g. design of new machinery, selection of the first approximation in iterative calculations) require the approximate determination of certain parameters other than the specified parameters. The experts in the technical fields concerned usually are familiar with specific probabilistic and functional relationships between parameters and can draw on their memories of previously encountered situations. But the estimation of parameters often involves ponderous calculations and hence the article deals with the utilization of experts knowledge of this kind to perform estimates by means of a computer. The pertinent algorithm is compiled on the basis of the division of the space of situations by means of parallel coordinate hyperplanes into a number of regions. TAB

N69-40205# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE APPLICATION OF MULTISTABLE ELEMENTS IN MULTISTATE DIGITAL TECHNOLOGY SYSTEMS
Yu. A. Vasilenko et al. 22 May 1969. 7 p. refs. Transl. into ENGLISH from Pribory i Sistemy Avtomat. (Kharkov), no. 6, 1967 p. 69 - 71
(AD-692049; FTD-HT-23-93-69) Avail: CFSTI CSCL 9/2

A complete system of functions of k-valued logic required for practical applications of multistable logic elements in computing or automatic control systems based on multistate logic e.g., decimal is explained. Though at the present time there is no criterion of completeness of such a complement, serveral workers have developed complete systems of functions. Among the most important are those of Post, Rosset and Tewkett, and Webb. The authors briefly review each of these systems which are based on the pulse position modulation and are thus simple and reliable. Author (TAB)

N69-40209 Marquette Univ., Milwaukee, Wis.
AN INVESTIGATION OF PULSE TRANSMISSION-REFLECTION TECHNIQUES AS MEANS FOR ULTRA-FAST LOGIC
Thomas Alois Kriz (Ph.D. Thesis). 1968. 120 p. refs.
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00. Order No. 69-3318

The utilization of pulse transmission and reflection phenomena in diode loaded transmission line networks as means to generate binary logic functions at microwave repetition frequencies is described in this dissertation. The scope of the discussion concerns the use of nanosecond pulse signals in TEM transmission line logic block networkds which employ diode switch controlled transmission and reflection phenomena together with such other operating principles as diode pulse steering and signal waveform interaction. Two new logic block families which utilize these principles are described. Nanosecond pulse signals are used as operators and operands in these logic blocks to generate pulse logic outputs. Since the generated information is not made continuously available, the logic systems are dynamic rather than static. A description of multiplexers and other system accessory circuits for pulse generation and volatile memory which may be used with the pulse transmission and reflection logic blocks is also given. Dissert. Abstr.

N69-40211 Michigan Univ., Ann Arbor.
STUDY OF PSEUDO-RANDOM NUMBER GENERATORS
Charles Cooper Hoopes (Ph.D. Thesis). 1968. 389 p. refs.
Avail: Univ. Microfilms: HC $17.55/Microfilm $5.00. Order No. 69-2327

Five prime base generators which have both computer programming and hardware implementation advantages are studied. The general theory developed for studying the statistical properties of PR number sequences is applied to the number sequences produced by these generators. Bounds are established for which the sequence passes the serial test for each of the generators independent of the maximal characteristic polynomial of the generator. Examples of the autocorrelation function and the serial analysis plot are given. Computer programming and hardware methods of implementing linear prime base generators are presented. Dissert. Abstr.

N69-40226# Naval Research Lab., Washington, D.C.
THE 3800 COMPUTER INTEGER DATE REQUEST SUBROUTINE
John H. Houston. Feb. 1969. 15 p. *Its* Computer Bull. No. 10
(AD-690864; NRL-MR-2008) Avail: CFSTI CSCL 12/1

A subroutine has been written in Compass for the CDC 3600/3800 computer to allow the current date to be obtained as month, day, year, and Julian form integer values for use in computation. Author (TAB)

N69-40243# Rome Air Development Center, Griffiss AFB, N.Y.
THE TABLE DRIVEN AUGMENTED PROGRAMMING ENVIRONMENT: A GENERAL PURPOSE USER ORIENTED

PROGRAM FOR EXTENDING THE CAPABILITIES OF OPERATING SYSTEMS

Edward Morenoff Jun. 1969 126 p refs

(AD-690606; RADC-TR-69-108) Avail: CFSTI CSCL 9/2

The Table Driven Augmented Programming Environment is a generalized program developed to significantly extend the capabilities of an existing multiprogramming computer system without interfering with its normal operation. The service of the Table Driven Augmented Programming Environment are available to a user at the same time the host computer system is engaged in its normal work load. These services allow the user to: (1) construct large programs from independently designed and implemented program modules maintained in a program library; (2) reference data in tables through an extensive data description facility; (3) disregard essentially any considerations of core storage space requirements through the use of an automatic software page turning facility; (4) temporarily bolt specified tables of data in core storage in order to operate on them with machine language instructions for higher efficiency; (5) treat all secondary storage as symbolically defined, random access files organized in a multi-level store; (6) communicate with the Table Driven Augmented Programming Environment in either a batched or interactive mode. The Table Driven Augmented Programming Environment can continue to be operated in the face of changing hardware configurations. Variations in the number and type of input/output communications devices, secondary storage devices, and the core storage can be accommodated for within wide limits. Author (TAB)

N69-40285# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ASYNCHRONOUS ITERATIVE-CIRCUIT STRUCTURES WITH INDIVIDUAL BEHAVIOR ON POTENTIAL ELEMENTS

I. P. Yegorov et al 30 Jan 1969 12 p refs Transl. into ENGLISH from Tr. Simp. po Probl. Vychislitelnyye Sistemy (Novosibirsk), 1967 p 215 - 222

(AD-692142; FTD-MT-24-468-68) Avail: CFSTI CSCL 9/2

Universal tunable iterative-circuit structures are considered which possess the following characteristics (1) The structure consists of different but regular recurrent elements and links between them (2) The structure is logically complete permitting, in principle, the realization of any finite automation (3) The structure is tunable by control signals. In the structures based on NOR or NAND or implication elements, the completeness of links is determined by the possibility of constructing both forward and inverse branches between any two nodes of corresponding graphs. These structures based on resistor-transistor elements are briefly examined (1) A structure consisting of intersecting horizontal and vertical chains describable by a planar antisymmetrical 4th degree graph (2) A modification describable by a nonplanar antisymmetrical 4th degree graph (3) A structure in which base-controlled transistors alternate with collector-controlled transistors describable by a symmetrical graph. Types of tuning and reliability of operation are briefly considered. Author

N69-40292# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A COMPUTER COMPLEX FOR SIMULATING COMPLEX PROBLEMS

V. M. Radunskiy et al 26 May 1969 8 p refs Transl. into ENGLISH from Tr. Simp. po Probl. Vychislitelnyye Sistemy (Novosibirsk), 1967 p 45 - 51

(AD-692137; FTD-HT-23-100-69) Avail: CFSTI CSCL 9/2

Several questions are examined on the structure of a computer complex intended (1) for the digital simulation of processes which develop parallel in time (2) for controlling an experiment in the operation of physical simulation and (3) for the mathematical processing of the results of an experiment. In particular, the complex can be used for solving the problems of simulating neuron networks. The algorithm of simulating neuron networks has certain characteristic features which are best carried out by a multicomputer system. The basic requirements on the complex are the following (1) the possibility of satisfying the algorithm simultaneously with several (up to eight) program branches (2) the presence of an operational high-capacity memory (20-30 thousand words) (3) the possibility of processing low-bit data. Author (TAB)

N69-40311# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN PROBLEMS IN ESTIMATE AND SELECTION OF OPERATIONAL BUILT-IN CONTROL SYSTEM IN COMPUTER DESIGN

G. N. Ushakova 6 Jun. 1969 19 p refs Transl. into ENGLISH from Tsifrovaya Vychisdetelnaya Tekhn. i Programmirovaniye (USSR), issue 2, 1967 p 70 - 82

(Contract F33657-68-D-0865/P002)

(AD-692190; FTD-HT-23-1342-68) Avail: CFSTI CSCL 9/2

The automatic hardware checkout reduces the time of fault detection and localization and augments the certainty of output information. However, additional equipment, which makes the hardware checkout possible, generally tends to reduce the computer reliability and to increase its cost. Hence, an optimal amount of equipment exists. The optimal system is evaluated on two criteria, certainty of information and faultless operation of computer. Formulas for probability of malfunctions and of correct operation are examined. An algorithm for evaluating each version of the hardware-checkout system of a digital computer during its planning stage is developed. Author (TAB)

N69-40366# Army Foreign Science and Technology Center, Washington, D.C.

A DEVICE FOR INTRODUCING MEASURING INFORMATION FROM THE CENTRALIZED CONTROL SYSTEM ZENIT-2 INTO A COMPUTER

B. Ya. Avdeev et al 25 Mar. 1969 10 p ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 10, no. 9, 1967 p 21 - 24

(AD-691320; FSTC-HT-23-407-68) Avail: CFSTI CSCL 9/2

In order to process measuring information from the analog ZENIT-2 into an electronic digital computer of the Minsk-2 type, a special analog-digital converter is required. The article describes such a device at the output of which a four-decade, binary-decimal 8-4-2-1 code necessary for a digital computer is obtained. The converter device it replaces worked only with the 1000s category, while the present provides for categories of the 1000s, 100s, 10s and units. The device consists of a scaling unit, a computing unit, a decoder, conversion of the pick-up number and the decimal time register number to binary-decimal code. The output of the converter is on punched tape or punched cards. Author (TAB)

N69-40378# Stanford Univ., Calif. Dept. of Computer Science.

STANDARD LISP

Anthony C. Hearn May 1969 34 p refs

(Contracts F44620-68-C-0075; ARPA SD-183)

(AD-691799; AI-MEMO-90) Avail: CFSTI CSCL 9/2

When it was first formulated in 1960, the programming language LISP was a truly machine independent language. However, even the earliest computer implementation encountered problems in input-output control and the handling of free variables which were not considered in the original paper. Successive implementations of LISP on more sophisticated machines have solved such problems by independent methods and introduced extensions of the language peculiar to those machines. The paper is an attempt to provide a uniform subset of LISP 1.5 and its variants as it exists today. The version of LISP described, which we call Standard LISP, is sufficiently restricted in form so that programs written in it can run under any LISP system upwardly compatible with LISP 1.5. As function names vary from system to system and input-output control is different, some modification of the code is of course necessary before function definitions can be successfully compiled in any given

system. However, this modification is performed automatically by a preprocessor, which is custom built for a particular system. TAB

N69-40404# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ASYNCHRONOUS LOGIC TIME AUTOMATA
E. A. Yakubaitis. 24 Jan. 1969. 24 p. refs. Transl. into ENGLISH from the Russian
(AD-691654; FTD-MT-24-487-68) Avail: CFSTI CSCL 9/2

The synthesis of time automata designed with real logic elements (AND, OR, NOT operating with finite delays) is considered. Two cases are examined, namely, a time automaton with noncontrollable square-pulse generator, and a time automaton with controllable square-pulse generator. TAB

N69-40420# Army Electronics Command, Fort Monmouth, N.J.
MINOS 3-ADAPTIVE-LEARNING/DIGITAL COMPUTER DATA CLASSIFIER
William A. Huber. Jun. 1969. 40 p. refs
(AD-691323; ECOM-3135) Avail: CFSTI CSCL 9/2

A description is given of the design, operation, and application of MINOS III, an experimental adaptive-learning/digital computer complex. This complex is dedicated to the problem of reducing the time required to filter, classify, and format data directly from real-world environments into a form suitable for direct use, or application to the ADP system. Principles of design and operation of the adaptive-learning section of MINOS III are described in detail. A discussion is also presented regarding machine training by use of sample data sets, and its subsequent ability to perform as a data classifier on similar but not identical data. Experimental techniques and operational results obtained from MINOS III applications are discussed. These discussions include MINOS III's ability to perform on the following types of problems: (1) classification of hand-printed map symbols, (2) recognition of military tanks, and (3) automatic reading of contour data from military maps. Author (TAB)

N69-40426# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Electrophysics.
STUDY OF THE APPLICATION OF CODING THEORY Final Report, 1 Apr. 1965 - 14 Nov. 1968
Arthur E. Laemmel and Beulah Rudner. 1 Jun. 1969. 93 p. refs
(Contract DA-31-124-ARO(D)-386)
(AD-691764; PIBEP-69-034; AROD-5978-2-M) Avail: CFSTI CSCL 9/4

Coding can be used to reduce errors or to compress the signal; the present report concerns the latter application. Several new results are given on constructing word sets, bounding expected word lengths, calculation of source information, use of generalized sequential machines, synchronization, and scanning in one and two dimensions. The report is part of a sequence in which it is hoped to develop a text-book coverage of the field of compression coding. Author (TAB)

N69-40428# RAND Corp., Santa Monica, Calif.
POGO: PROGRAMMER ORIENTED GRAPHICS OPERATION
B. W. Boehm, V. R. Lamb, R. L. Mobley, and J. E. Rieber. Jun. 1969. 43 p. refs
(Contract F44620-67-C-0045)
(AD-691808; RM-5825-PR) Avail: CFSTI CSCL 9/2

The paper gives a description of POGO, a fully operational system for easy interactive computer graphics programming. POGO is well suited to the interplay of computational programs with alphanumeric and curve input and display, though not to highly dynamic interplay with geometric manipulations. The POGO system includes: (1) A design program for composing control displays at the graphics console and interfacing them to a FORTRAN program. (2) A program to trace curves via the RAND Tablet into specified FORTRAN arrays. (3) A program to output curves from specified FORTRAN arrays onto the 2250 display screen. A glossary of computer graphics terminology is appended. TAB

N69-40486# Maryland Univ., College Park. Computer Science Center.
SEPARABLE GRAPHS, PLANAR GRAPHS AND WEB GRAMMARS
Ugo G. Montanari. Aug. 1969. 49 p. refs
(Contract Nonr-5144(00))
(AD-691826; TR-69-96) Avail: CFSTI CSCL 9/2

The paper is concerned with the class of web grammars, introduced by Pfaltz and Rosenfeld, whose languages are sets of labelled graphs. A slightly modified definition of web grammars is given, in which the rewriting rules can have an applicability condition, and it is proved that in general, this extension does not increase the generative power of the grammar. This extension is useful, however, for otherwise it is not possible to incorporate negative contextual conditions into the rules, since the context of given vertex can be unbounded. A number of web grammars are presented which define interesting classes of graphs, including unseparable graphs, unseparable planar graphs and planar graphs. All the grammars in this paper use normal embeddings in which the connections between the web that is written and the host web are conserved, so that any rewriting rule affects the web only locally. Author (TAB)

N69-40499# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INITIAL EXPERIMENTS ON THE EFFECTS OF SYSTEM DELAY ON ON-LINE PROBLEM SOLVING
Maxwell A. Morfield, Raymond A. Wiessen, Mitchell Grossberg, and Douwe B. Yntema. 24 Jun. 1969. 66 p. refs
(Contract AF 19(628)-5167)
(AD-691815; TN-1969-5; ESD-TR-69-158) Avail: CFSTI CSCL 9/2

Three experiments explored the way in which delay in the response of the system affects the users performance in solving problems with an on-line computing service. In each experiment there were four subjects under delay conditions of about 1 sec. to 100 sec. The on-line computing service was the Lincoln Reckoner. As expected, the average time the user required to complete a task increased as the response-delay increased, and the rate at which he demanded service declined as the delay increased. The relation of net completion time (time to complete the task, minus the time during which the user was waiting for a response) to response delay depended on the type of task. In the more realistic experiments, the net completion time increased with delay (suggesting that long delays are distracting). The number of outputs (i.e., displays or type-outs) per task was also considered. The main conclusion is that controlled experiments of this kind are feasible and can be used as the basis for design of on-line computing services. Author (TAB)

N69-40503# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
FINITE DIMENSIONAL SENSOR ORBITS AND OPTIMAL NONLINEAR FILTERING
James Ting-Ho Lo (Ph.D. Thesis). Aug. 1969. 61 p. refs
(Grant AF-AFOSR-1244-67)
(AD-691855; AFOSR-69-1935-TR) Avail: CFSTI CSCL 9/4

The filtering problem of a system with linear dynamics and non-Guassian a priori distribution is throughly investigated. The conditional probability density, conditional mean and conditional error covariance for this class of nonlinear problem are obtained in terms of an ordinary integral which is analogous to the solution of a heat flow problem of an infinitely long, homogeneous rod with a certain initial heat distribution. An approximation made in the construction of a mathematical model is introduced. It renders the optimal estimation to a combination of linear estimations and thus gives satisfactory filtering in practice. The asymtotic behavior of the filter is examined. The limiting distributions of the conditional mean

and the conditional error covariance exist as the time interval of observation becomes infinite. In the autonomous case, the estimate for the Wiener problem satisfies a linear stochastic differential equation. A large class of nonlinear problems with more nonlinear features than the one discussed above can be reduced to it through the idea of finite dimensional sensor orbit. The general idea and a number of examples are discussed briefly. Author (TAB)

N69-40539# Missouri Univ., Columbia. Dept. of Industrial Engineering.
NONCONTINUOUS ACTIVITIES IN PROJECTS AND PARPS
Richard Lawrence Weber (M.S. Thesis) Jan. 1969 321 p refs Supported by AF
(AD-691820) Avail: CFSTI CSCL 5/1

The development of a method by which the usual PERT/CPM project analysis technique can be extended to include both continuous and non-continuous activities in the same project network is described. By permitting the analyst or researcher to type each activity as to whether it is to be worked on any day (continuous) or only on working days (non-continuous) a greater degree of reliability, accuracy, and realism can be attained when such is determined to be necessary. Algorithms and procedures are presented with which existing computer assisted project analysis systems can be readily modified to permit the inclusion of non-continuous activities. Also described is the development of PARPS, a computer programming language for project analysis that is directed towards the researcher, but will also find application in virtually all areas of endeavor. Twenty-five commands are provided with which the user can control the processing of his network. Activities can be specified as continuous or non-continuous and durations can be deterministic or probabilistic. Author (TAB)

N69-40541# System Development Corp., Santa Monica, Calif.
TWO APPROACHES FOR MEASURING THE PERFORMANCE OF TIME-SHARING SYSTEMS
Arnold D. Karush 16 May 1969 33 p refs Presented at the 2d ACM Symp. on Operating System Principles, Princeton, N.J., 20-22 Oct. 1969
(AD-691366; SP-3364) CSCL 9/2

There are two significantly different approaches that can be used for measuring the performance of time-sharing systems. The stimulus approach which conceptualizes the system as a black box containing a limited number of known functions, involves applying a controlled set of stimuli to the black box in order to activate its functions, and then observing the results. In the analytic approach, probes are inserted into the system to allow the recording of any level of the systems behavior. Both approaches are being developed for, and have been used to measure, System Development Corporations ADEPT time-sharing system. Author (TAB)

N69-40611# System Development Corp., Santa Monica, Calif.
PREDICATE NOMINALS: LEXICALLY SIMPLE AND LEXICALLY COMPLEX
Marianne Celce and Robert M. Schwarcz 15 Jul. 1969 24 p refs
(Contract F33615-68-C-1473)
(AD-691427; SP-3379) Avail: CFSTI CSCL 5/7

The paper is the third in a series of working papers whose purpose is to report the findings of the linguistic research now being done as a part of a Computer-Aided Instruction Project. Previous papers in the series by the same authors are A Note on Two Basic Semantic Distinctions (AD-686 743), and Counting, Collecting, Measuring, and Quantifying in English (AD-691 096). The paper investigates syntactic and semantic differences between predicate nominals and noun phrases in English. In order to pinpoint the differences, surface structure phenomena, anaphoric and substitute expressions, and message structure relations are explored. In the second part of the paper the difference between lexically simple and lexically complex predicate nominals is discussed and a lexico-syntactic solution is proposed that allows lexically complex and simple predicate nouns to be treated adequately at the level of surface syntax, as well as semantically at the level of message structure. Author (TAB)

N69-40613# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SEARCH ALGORITHM FOR SOLUTIONS WITH FUNCTIONAL, COMPLETELY DEFINED AND SUBJECTIVE MAPPINGS
G. K. Goranskii 11 Dec. 1968 44 p refs Transl. into ENGLISH from Vychislitelnaya Tekhn. Mashinostr. (USSR), 1966 p 3-36
(AD-691666; FTD-HT-23-706-68) Avail: CFSTI CSCL 12/2

An investigation is made of a method for finding a solution satisfying a specified union of given conditions from a set of possible solutions related with conditions of correspondence. The article presents the basis of the search method, an example, and an ALGOL-60 program for performing the search. The algorithm applies to a class of problems in machine design. The steps taken in the computer program logic are described in sequence. An example is shown in which the search algorithm is applied to the selection of a special machinery clamp attachment from a catalog set of 22 possible attachments. The example demonstrates how the search procedure measures candidate parts according to the design criteria. A flow chart of the ALGOL program is given in macroscopic form. TAB

N69-40648# Naval Research Lab., Washington, D.C. Radar Div.
CDC 3800 COMPUTER SUBROUTINE TO PRODUCE THREE-DIMENSIONAL SURFACE PLOTS ON THE 565 CALCOMP PLOTTER Final Report
John C. Moore Apr. 1969 20 p ref *Its* NRL Computer Bull. 15
(AD-691420; NRL-MR-2015) Avail: CFSTI CSCL 9/2

A CDC 3800 Computer subroutine, SURFACE, has been written in FORTRAN to allow three-dimensional surface plots to be generated on the 565 CalComp plotter. This subroutine will produce a surface plot of data that can be reduced to one single-valued dependent and two independent variables. Author (TAB)

N69-40737# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
A REVISED FORTRAN 4 PROGRAM TO CALCULATE CRYSTALLOGRAPHIC FUNCTIONS
George J. Werkema 14 May 1969 10 p
(Contract AT(29-1)-1106)
(RFP-1329) Avail: CFSTI

A revision of a program written earlier for a small computer is presented. The availability of a computer having a medium-to-large memory permits various improvements in operating convenience to be made. The present program has been written in IBM 360 E-level FORTRAN IV. Values of the interplanar spacing "d," $\sin 2\theta$, and 2θ are calculated for the crystallographic planes *hkl*. Planes that are found to be systematically nonreflecting by virtue of the space group symmetry elements coded in the data are omitted from the output list. The calculated results are sorted on increasing 2θ in blocks of 2000 before listing. Author (NSA)

N69-40752# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROGRAMMING INFORMATION AND LOGIC PROBLEMS. PART 2: SELECTED ARTICLES
A. I. Kitov 26 Feb. 1969 63 p Transl. into ENGLISH from the book "Programmirovaniye Inform. Logicheskikh Zadach" Moscow, Sovetskoye Radio, 1967 p 100-188
(AD-691644; FTD-HT-23-230-68) Avail: CFSTI CSCL 9/2

The book presents the principles and procedures for programming information and logic problems such as the processing of economic data, searching for scientific or technical information, etc. An expanded algorithmic language based on ALGOL and

which contains within itself the capacity to process compound quantities and lists is examined. Included is a description of the memory storage capability in the machine and the process of handling various types of lists; all of which assure a rapid search for data in an immense inventory of information. TAB

N69-40771# Houston Univ., Tex.
ON THE USE OF VERY LOW COST TERMINALS
Albert Newhouse and Robert A. Sibley, Jr. Mar. 1969 25 p refs Presented at the Intern. Conf. on Remote Data Process., Paris, Mar. 1969
(Contract N00014-68-A-0151)
(AD-691398; RE-3-69) Avail: CFSTI CSCL 9/2

This effort seeks to maximize the number of places (cities, buildings, rooms, desks,...) from which people can interact with digital computers in a meaningful way. Because of the extraordinary availability and low cost of the ordinary telephone, it was chosen as the corner-stone of the project. A set of possible applications were then identified. These applications include desk calculator services (scientific and business); information storage and retrieval (public assistance and private industry); and computer program development. For each category of applications, the identification of specific services is followed by a study of input/output language problems, economic considerations and human factor problems. These studies have involved the design and implementation of a specific hardware/software system. Telephone signals are interfacec and multiplexed into an Interdata Model 14 computer in the same manner as teletype messages. Output is generated by a Cognitronics Speechmaker as a consequence of selection codes that are presented to a specially designed buffer. Requirements for large data collections and computational services are satisfied by a high speed connection to the University's central computing facility. Author (TAB)

N69-40846# New York Univ., N.Y. Courant Institute of Mathematical Sciences.
BALM AN EXTENDABLE LIST PROCESSING LANGUAGE
Malcolm G. Harrison. Jun. 1969 20 p refs
(Contract AT(30-1)-1480)
(NYO-1480-118) Avail: CFSTI

An extendable list-processing system currently implemented on the CDC 6600 which includes the facilities provided by LISP 1.5, and permits the programmer to write in an Algol-like language is described. Additional data-types include vectors, strings, and entry-points. The language can be extended by adding new operators, and by specifying how expressions involving them should be translated into an intermediate language. Author (NSA)

N69-40868# New York Univ., N.Y. Lab. for Electroscience Research.
ON THE COMPUTER DRAWING OF SOLID OBJECTS BOUNDED BY QUADRIC SURFACES
Peter Woon. Jun. 1969 76 p refs
(Grant AF-AFOSR-1367-68)
(AD-691484; AFOSR-69-1894TR; TR-403-3) Avail: CFSTI CSCL 9/2

The paper is a status report on a research project to develop and implement a computer procedure for generating line drawings of solid objects bounded by quadric surfaces. The emphasis of the research is on finding an efficient solution to the hidden-line problem, that is, the problem of determining which parts of an object are visible from a given vantage point. Some computational techniques for handling quadric surfaces are described. To avoid excessively time-consuming computation with high-degree nonlinear equations, certain curves are approximated by sequences of small straight-line segments. Special methods for treating such approximations are developed. Author (TAB)

N69-40894*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
DESIGN METHODS FOR FAULT-TOLERANT NAVIGATION COMPUTERS
Algirdas Avizienis. 15 Oct. 1969 15 p refs
(Contract NAS7-100)
(NASA-CR-106409; JPL-TR-32-1409) Avail: CFSTI CSCL 09B

Discussed the problem of fault tolerance in digital computers with strong emphasis put on computers used in on-board navigation systems of aircraft and spacecraft. An extension of automatic maintenance to an entire navigation system is introduced. Two principal approaches to fault tolerance in navigation computers are analyzed. Examples are taken from recent aerospace computers, the Saturn V computer, and the Self Testing And Repairing spacecraft guidance computer. The problem of fault tolerance is identified and defined, and current applications of the computers are discussed. Some current exploratory research and research objectives for the future are described. Author

N69-40901# Air Force Cambridge Research Labs., Bedford, Mass.
THE COMPUTER-CONTROLLED EXPERIMENT AND ON-LINE ANALYSIS
Roy Kaplow and Harold Posen. May 1969 28 p refs *Its* Phys. Sci. Res. Paper No. 379
(AD-691430; AFCRL-69-0187) Avail: CFSTI CSCL 14/2

An analysis procedure and data accumulation scheme that allows an interactive computer-control system to be implemented for a class of physical experiments is described in terms of continuously derivable experimental results. The method is applicable whenever the derivable physical parameters can be expressed in terms of integrals over functions of the measured quantities and reciprocal relationships allow prediction of the measured values in terms of the derived quantities. Applications of the analysis are shown for the measurement of short-range-order parameters in alloys. Author (TAB)

N69-40942# Oak Ridge National Lab., Tenn. Neutron Physics Div.
SPACETRAN: A CODE TO CALCULATE DOSE AT DETECTORS AT VARIOUS DISTANCES FROM THE SURFACE OF A CYLINDER
S. N. Cramer and M. Solomito. 17 Jun. 1969 43 p refs Sponsored in part by DASA and AEC
(ORNL-TM-2592) Avail: CFSTI

Program SPACETRAN is a Fortran code designed to calculate the energy-dependent total flux, or some proportional quantity, due to the radiation leakage from the surface of a right-circular cylinder at detector positions away from the surface. Two versions of the SPACETRAN code are described. One uses the surface angular fluxes calculated by the S_n code ANISN as the input; the other uses the surface angular flux described by a cosine distribution. Both versions of the code permit an arbitrary energy group structure and any number of detectors at any positions away from the surface. Author (NSA)

N69-40975# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
STEEPEST ASCENT FOR LARGE-SCALE LINEAR PROGRAMS
Richard C. Grinold. Apr. 1969 45 p refs
(Contracts N00014-67-A-0298-0006; N00014-67-A-0298-0005; N00014-67-A-0298-0008)
(AD-691841; TR-587) Avail: CFSTI CSCL 12/2

Many structured large-scale linear programming problems can be transformed into an equivalent problem of maximizing a piecewise linear, concave function subject to linear constraints. The equivalent problem can, in turn, be solved in a finite number of steps using a steepest ascent algorithm. This principle is applied to block diagonal systems yielding refinements of existing algorithms. An application to the multi-stage problem yields an entirely new algorithm. Author (TAB)

N69-41079# California Univ., Livermore. Lawrence Radiation Lab.

BOMM/LRL: A SYSTEM OF PROGRAMS FOR ANALYSIS OF TIME SERIES

Robert J. Stinner and David S. Bailey 17 Apr. 1969 50 p ref
(UCRL-50646) Avail: CFSTI

The BOMM code for spectral analysis of digitized series designed for use on the IBM 7090 computer has been modified to BOMM/LRL to run on the CDC 6600 computer using the Chippewa compiler and the FROST monitor system at Lawrence Radiation Laboratory. (The BOMM code was developed at the Institute of Geophysics and Planetary Physics at the University of California at La Jolla.) Features of BOMM/LRL include the ability to join, merge, or decimate series at will; to analyze and correct them for errors; and finally to convolve, transform, or cross-correlate as desired. Fader windows, filters, and other types of series that have desired characteristics can be generated as needed. Results can be plotted on the on-line printer or on the CRT. In the process of conversion, all tape usage (series storage, chain-link storage, etc.) was eliminated and replaced by disk storage of series. On sample problems, an improvement of 6 to 10 times faster in running the time than the IBM 7090 has been achieved. Author (NSA)

N69-41109# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.

COMPUTER PROGRAMS FOR DETERMINING PAYOUT EYE POSITIONS FOR LAYING FILAMENTS ALONG GEODESIC PATHS ON SURFACES OF REVOLUTION

T. W. Bookhart and A. H. Fowler 13 Nov. 1968 56 p refs
(Contract W-7405-eng-26)
(Y-1620) Avail: CFSTI

FORTRAN computer programs have been written for determining a geodesic path on an arbitrary surface of revolution. For this geodesic path on the surface, the corresponding payout-eye locations are calculated so that a machine will lay the filament along this geodesic path. Mandrel geometry and eye clearance are considered in locating the payout eye. The output of the program is a listing of points along the surface and the corresponding payout-eye positions. This information is then processed by an APT postprocessor to produce a punched tape for a numerically controlled filament winder. Author (NSA)

N69-41151*# University of Southern Calif., Los Angeles.

TRANSFORM PROCESSING AND CODING OF IMAGES
Final Report

William K. Pratt and Harry C. Andrews Mar. 1969 133 p refs
Prepared for JPL
(Contract NAS7-100)
(NASA-CR-106376; USCEE-341) Avail: CFSTI CSCL 09B

A new approach to the problem of image coding is described which achieves a reasonably large bandwidth reduction and offers a certain immunity to channel errors without significant image degradation. Implementation is presently considered feasible for slow-scan image systems. The general properties of image transforms are treated, and specific experimental examples of the performance of the Fourier and Hadamard image transforms are given. A.C.R.

N69-41188*# Hughes Aircraft Co., Fullerton, Calif.

RESEARCH IN THE EFFECTIVE IMPLEMENTATION OF GUIDANCE COMPUTERS WITH LARGE SCALE ARRAYS
Interim Report

J. J. Pariser, F. D. Erwin, J. F. McKevitt, J. A. Burke, and C. D. Disparte Sep. 1969 123 p refs Revised
(Contract NAS12-665)
(NASA-CR-86256; FR-69-11-1000-Rev. IR-2) Avail: CFSTI CSCL 09B

This study applies functional logic characters to the selected system design of the NASA modular computer (NMC) as represented by a modular computer breadboard (MCB). The characters are specified as the building blocks and a repertoire of microprogram instructions is defined. The character set totals ten unique building blocks, which are interconnected as shown in the figure to form digital equipments. A micromemory word of 50 bits is specified. It may be utilized either singly or in pairs, each containing two instructions and a constant field. Based on available information of the MCB computer, a design of each of the five units was completed using the functional characters. The design of each unit in general includes selecting proper characters and microprogramming the operation of each character to provide all specified MCB machines instructions and operations. Implementation of the MCB using functional characters is evaluated resulting in favorable operating time, reduced pins, reduced total cards, and reduced card types. A significant portion of this report is devoted to demonstrating the application of a minimal set of general-purpose functional characters (logic arrays) to the implementation of an existing logic design of a general-purpose computer (the MCB). Author

N69-41271# Stanford Research Inst., Menlo Park, Calif.

STANFORD RESEARCH INSTITUTE STUDY, VOLUME 1. PART 1: POLICY ISSUES PRESENTED BY THE INTERDEPENDENCE OF COMPUTER AND COMMUNICATIONS SERVICES. PART 2: ANALYSIS OF POLICY ISSUES IN THE RESPONSES TO THE FCC COMPUTER INQUIRY. PART 3: DECISION ANALYSIS OF THE FCC COMPUTER INQUIRY RESPONSES. PART 4: PATTERNS OF TECHNOLOGY IN DATA PROCESSING AND DATA COMMUNICATIONS, 1 JUL. - 31 DEC. 1968

D. A. Dunn, L. I. Krause, A. J. Lipinski, H. M. Zeidler, and L. J. Moll Feb. 1969 518 p refs
(Contract RC-10056)
(PB-183612; Rept-7379B-1-Vol-1) Avail: CFSTI CSCL 09B

The four reports in this volume and the three in Volume 2 concern the FCC Computer Inquiry and an analysis of the policy issues posed in the industry. The United States has both a highly successful data processing industry and an extremely capable and effective communications industry. Therefore, any general approach to the problems arising out of the interdependence of these industries in the U.S. should preserve the favorable environment that has allowed these industries to achieve their present strength and vitality. USGRDR

N69-41272# Stanford Research Inst., Menlo Park, Calif.

STANFORD RESEARCH INSTITUTE STUDY, VOLUME 2. PART 5: DIGESTS OF THE RESPONSES TO THE FCC COMPUTER INQUIRY. PART 6: A PREFACE TO A THEORY OF REGULATION. PART 7: A DYNAMIC FINANCIAL MODEL OF A UTILITY, 1 JUL. - 31 DEC. 1968

A. J. Lipinski Feb. 1969 288 p refs
(Contract RC-10056)
(PB-183613; Rept-7379B-5-Vol-2) Avail: CFSTI CSCL 09B
For abstract see N69-41271

N69-41287# Atlantic Richfield Hanford Co., Richland, Wash.

ON-LINE COMPUTER AND DATA TRANSMISSION NETWORK SUPPORTING TWO NUCLEAR ANALYTICAL LABORATORIES

W. C. Johnson, Jr. and Roy A. R. Kent 14 Aug. 1968 18 p
Presented at the Am. Chem. Soc. Meeting, Atlantic City
(Contract AT(45-1)-2130)
(ARH-SA-19) Avail: CFSTI

An on-line data retrieval and update system is described in supporting the analytical laboratories at ARHCO's Chemical Processing complex in Richland, Washington. Much of the repetitive-type work that is performed in the laboratories is handled by the computer system which incorporates queueing techniques and interrupt routines for servicing the many terminals. The computer is located in the analytical laboratory of one nuclear facility and classified lines connect the terminals located within this facility. Non-classified lines connect the computer to terminals in two other

nuclear facilities which are geographically located 1.5 and 5.5 miles away. Author (NSA)

N69-41369# Auburn Univ., Ala. Digital Systems Lab.
AN ALGORITHMIC APPROACH TO SEQUENTIAL AUTOMATA DESIGN
Chester C. Carroll and W. L. Oliver, Jr. Jul. 1969 78 p refs
(Contract DAAH01-68-C-0296)
(AD-691768; AU-T-1) Avail: CFSTI CSCL 9/2

The economical design and implementation of sequential networks is the object of much sequential automata theory, but no generalized solution insuring minimum cost has yet been developed in the theory. Several techniques for cost reduction have been presented in the literature. The majority of these techniques, however, are concerned with special classes of automata. Developed in this work is an automated procedure for sequential network design that uses economizing methods applicable to any general state table. Major emphasis is placed on relatively small subsystem-type automata rather than large systems of such complexity that excessive computer capacity and usage are required. Evidence as to the goodness of the procedure is presented from a comparison with the results of other techniques. Author (TAB)

N69-41375# Avion Electronics, Inc., Paramus, N.J.
COURSE LINE COMPUTER/PICTORIAL DISPLAY. Final Report
M. Sigman. 21 Oct. 1968 53 p
(Contract FA-67-WA-1645)
(AR-2531; SRDS-RD-68-56) Avail: Issuing Activity CSCL 09B

An extensive modification was made to a Course Line Computer/Pictorial Display (CLC/PD). The major objective was the construction of a new type of display which permits the pilot to choose any map at the scales of 40 NM/inch, 20 NM/inch, 10 NM/inch or 5 NM/inch by merely "dialing" a station and scale and activating a reset button on the Display front panel. Once a map is chosen, and assuming that the aircraft and destination are within the area encompassed by the map, an aircraft marker and a destination marker appear in proper geographical location on the map. In addition, the aircraft marker indicates heading with respect to magnetic North. Other modifications included the substitution of more reliable relays and relay sockets in the Course Line Computer, ability to set distance to destination in 1/2 NM rather than 1 NM intervals, greatly improved display lighting and display of the warning flag directly over the chart. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N69-40066*# Sperry Rand Research Center, Sudbury, Mass.
INVESTIGATION OF NEW CONCEPTS OF ADAPTIVE DEVICES. Quarterly Technical Report, 3 Dec. 1968 - 2 Mar. 1969
E. Lewis, F. Sewell, and H. A. R. Wegener. Apr. 1969 29 p
(Contract NAS12-570)
(NASA-CR-86254; SRRC-CR-69-7; QR-6) Avail: CFSTI CSCL 09A

The conduction mechanisms in the insulator structure of the MI_2I_1S memory device are discussed, and the equations necessary to describe the transient behavior of the device, including the effect of the semiconductor space charge layer are developed. A model is proposed that accounts for the storage of both positive and negative charge. This is accomplished by considering the effects of electronic traps quantitatively. Both the density of traps and their depth have a distinct influence on the charging characteristics. Author

N69-40079*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF PRESSURIZED LIQUID NITROGEN INSIDE PARAMETRIC-AMPLIFIER STRUCTURES FOR INPUT-NOISE-TEMPERATURE IMPROVEMENT
Hans-Juergen C. Blume. Washington, Oct. 1969 31 p refs
(NASA-TN-D-5509) Avail: CFSTI CSCL 09E

The temperature rise caused by power dissipation in lossy capacitance diodes in cooled parametric amplifiers, especially in monostatic high-power radar systems, diminished the noise-reduction effect of the coolant. To obtain good heat conduction from the diode so that it would remain at ambient temperature, liquid nitrogen helium gas under pressure was employed as dielectric material surrounding the lossy diode. All adjustments for optimum performance of a 400-MHz amplifier were accomplished at room temperature before immersion into liquid nitrogen by using calculated and measured values from curves that showed resonant frequency variation of each circuit due to the change of the relative dielectric constant from 1 to 1.435, the slight change of the physical dimension caused by thermal contraction, and the change of the operating frequency at high gain. Author

N69-40098# Defense Documentation Center, Alexandria, Va.
RESISTOR TECHNOLOGY, VOLUME 1. Report Bibliography, Jan. 1962 - Mar. 1969
Jul. 1969 160 p refs
(AD-691100; DDC-TAS-69-42-Vol-1) Avail: CFSTI CSCL 9/1

The bibliography consists of two sections. Section I pertains to resistors as discrete, miniature and microelements. Passive resistive elements are deposited on wafers, ribbon, and resistive sheet. The miniature and microelements are assembled into micromodules. Section II pertains to resistive elements which are deposited as integrated and microcircuit wafers. These integrated and microcircuits are constructed as a block or multilayer on a semiconductor substrate and combine to form hybrid microcircuits, integrated circuits, and thin-film circuits. Author (TAB)

N69-40143*# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
DIRECTIVE GAIN OF CIRCULAR TAYLOR PATTERNS
D. C. F. Wu and R. C. Rudduck. 12 Aug. 1969 13 p refs
(Grant NGR-36-008-005)
(NASA-CR-66850; TR-1691-32) Avail: CFSTI CSCL 09E

The directive gain of circular Taylor patterns is determined. It is shown that so-called optimum patterns, i.e., uniform sidelobes in all planes, are severely limited for planar apertures because of excessive sidelobe power. It is shown that optimum directive gain of the circular Taylor pattern with a given sidelobe level can be obtained by appropriate design. Two parameters, a quantity uniquely related to the design sidelobe level and a number controlling the degree of uniformity of the sidelobes, have been determined to achieve the optimum directive gain. Author

N69-40201*# Sperry Rand Research Center, Sudbury, Mass.
INVESTIGATION OF NEW CONCEPTS OF ADAPTIVE DEVICES. Quarterly Technical Report, 15 Sep. - 14 Dec. 1967
F. A. Sewell, Jr., E. T. Lewis, and H. A. R. Wegener. Jan. 1968 26 p
(Contract NAS12-570)
(NASA-CR-86250; SRRC-CR-68-8; QTR-2) Avail: CFSTI CSCL 20

The monthly letters to date and the first quarterly report give a detailed theoretical analysis of the charge storage behavior of an MI_2I_1S device. The present quarterly report includes the results of several experiments, in particular J-E curves, which substantiate the theory. It is shown that it is possible to predict the relationship between the applied bias to a device and the charge stored in the device (hereafter referred to as bias-storage curves). From the same data charging and discharging times are quantitatively established. These three pieces of information

characterize the memory behavior of the MI_2I_1S device. Finally, an analysis of the MI_2I_1S equivalent circuit is given, showing that with the use of a properly designed analog computer, one can extract a representation of the charging current transient. Equipment is now being checked out which will provide a visual display of this function. Author

N69-40249# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE MODE SPECTRUM OF AVALANCHE DIODES
Henry Berger 3 Jun. 1969 16 p refs
(Contract AF 19(628)-5167)
(AD-690996; TN-1969-31; ESD-TR-69-144) Avail: CFSTI CSCL 9/1

Prior studies of IMPATT diodes have restricted their consideration to one-dimensional representations of these devices. In the present report, some qualitatively new modes of behavior are brought to light from a study of a more realistic multidimensional structure. The primary result of this study is the uncovering of a varied spectrum of new avalanche modes, whose character is discussed in some detail. This spectrum is found to be comprised of two different types of radial TM modes which are referred to as the symmetric and the unsymmetric modes. The totality of prior results of one-dimensional studies turn out to constitute the lowest order mode of the symmetric mode group. This is a quasi-TEM radial wave avalanche mode, which is a bulk mode. The remaining symmetric modes that have been investigated turn out to constitute a new type of avalanche phenomena involving avalanche surface wave modes. The unsymmetric modes correspond most simply to bulk wave modes, but differ considerably from the quasi-TEM bulk mode mentioned above. Author (TAB)

N69-40271*# Sperry Rand Research Center, Sudbury, Mass.
INVESTIGATION OF NEW CONCEPTS OF ADAPTIVE DEVICES Quarterly Technical Report, 15 Sep. - 14 Dec. 1968
E. Lewis and H. A. R. Wegener 14 Dec. 1968 11 p refs
(Contract NAS12-570)
(NASA-CR-86253; SRRC-CR-68-51) Avail: CFSTI CSCL 09A

Silicon wafers were subjected to high-temperature surface treatments prior to the deposition of silicon nitride to study the effect of heat and light on the charge storage properties of the silicon nitride memory capacitor. The surface treatments consisted of exposing the silicon surfaces to hydrogen and ammonia atmospheres at 1250°C prior to the deposition of silicon nitride. The deposition was performed in hydrogen at 900°C. This approach resulted in a different surface and revealed some interesting features on interface conduction mechanisms. The effect of light on the charge storage properties of a memory capacitor was found to be related to a space charge layer in the silicon adjacent to the insulator. With a relatively intense light directed on the surface of the device, this space charge layer can be practically eliminated. Author

N69-40361*# Sperry Rand Research Center, Sudbury, Mass.
INVESTIGATION OF NEW CONCEPTS OF ADAPTING DEVICES Quarterly Technical Report, 15 Dec. 1967 - 14 Mar. 1968
E. Lewis, M. Cohn, A. Lincoln, F. Sewell, M. Doig et al Apr. 1968 22 p
(Contract NAS12-570)
(NASA-CR-86251; SRRC-CR-68-20; QTR-3) Avail: CFSTI CSCL 09E

An application of the metal nitride semiconductor/variable threshold transistor, a transient solution of the charging current, some elements of device fabrication, and a technique for the charge storage prediction at the I_2-I_1 interface are discussed. For the application of the memory transistor, a learning machine was constructed that uses the charge stored in the gate structure to control the threshold voltage which in turn can be used to influence a series of logic functions. The output of these logic functions consists of a reward and a punish decision. It is shown that learning can be accomplished even by an imperfect trainer. The only requirement of the trainer is that he make more correct than incorrect decisions. The transient solution for the charging current in the MI_2I_1S structure was accomplished by an analog computer. The computer solved a differential equation formulated from an electrical equivalent circuit of the device structure. The result compares favorably with an approximate mathematical solution. Some processing results and a summary of the method of charge storage prediction are presented. It is shown that a thermal oxide interface is more desirable than one grown pyrolytically. Author

N69-40365# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A TRANSISTORIZED dc-ac INVERTER
A. L. Semenyuk et al 9 Jun. 1969 7 p refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 6, 1968 47 - 48
(AD-691647; FTD-HT-23-184-69) Avail: CFSTI CSCL 10/2

The termopribor design bureau has developed the PN-025 transistorized voltage inverter. The PN-025 converts 24-v dc into 220-v ac at 50 Hz. The transformer operates under saturation conditions and carries out the switching of the transistor. To stabilize the frequency in the inverter and make it independent of the supply voltage and load variations, a series oscillatory LC circuit is used. Thus, with plus or minus 10 percent supply voltage variations the frequency variations at the inverter output do not exceed plus or minus 1 percent. Test samples of the inverter successfully completed laboratory and industrial tests, and preparations are being made for lot production. Author (TAB)

N69-40380# RAND Corp., Santa Monica, Calif.
A TECHNIQUE FOR IMPROVING WIREABILITY IN AUTOMATED CIRCUIT CARD PLACEMENTS
R. Lawrence Clark Aug. 1969 16 p refs
(AD-691637; P-4049) Avail: CFSTI CSCL 9/1

The report describes a method for automatically placing electronic components on printed circuit cards. The method is based on the idea of evaluating numerous trial placements and selecting the best. Author (TAB)

N69-40396*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXTREME TEMPERATURE REQUIREMENTS FOR SPACECRAFT ELECTRONICS PARTS. FY 69 REPORT: THE LOW TEMPERATURE CASE
T. Hutchinson 15 Jul. 1969 39 p
(Contract NAS7-100)
(NASA-CR-106332, JPL-701-29) Avail: CFSTI CSCL 09A

The Extreme Temperature Requirements (ETR) study purpose is the determination of the extremes of temperature which will be experienced by electronics components on future spacecraft. This information will be utilized 1.) to evaluate the capability of existing parts and 2.) as design criteria for new piece parts. The case considered during FY 69 was Thermoelectric Outer Planets Spacecraft Advanced System Technology, Document TOPS-2-100, a spacecraft planned for use in the Grant Tour Mission of the Outer Planets. This was chosen because it represented the low temperature extreme of any planetary flyby mission planned in this century. Preliminary studies indicated that temperature extremes would be encountered at locations remote from the main spacecraft bus, i.e., the science experiments and attitude control sensors. The types of electronic parts contained in units at these remote locations were identified. Thermal studies were performed to determine how severe the thermal environments would be and to help evaluate the constraints imposed on the mission by not having parts with an extremely low temperature (-200°C) survival capability. Author

N69-40402*# Sperry Rand Research Center, Sudbury, Mass.
INVESTIGATION OF NEW CONCEPTS OF ADAPTIVE DEVICES Quarterly Technical Report, 15 Jun. - 14 Sep. 1967
H. A. R. Wegener, A. J. Lincoln, and H. C. Pao Dec. 1967 50 p
(Contract NAS12-570)

(NASA-CR-86249; SRRC-CR-67-62; QTR-1) Avail: CFSTI CSCL 09A

An insulated gate field effect transistor (IGFET) with memory and adaptive characteristics is described. The memory cell acts as an inverter and its output current as a function of applied gate voltage. Information is stored by setting the threshold voltage of the IGFET to a high or low value. A high threshold voltage is written by applying a pulse of -50 V for a duration of 1 msec or less between gate and substrate. A low threshold voltage is similarly obtained with a positive 50 V pulse. Data on the persistence of the information indicates a storage time of a few months at room temperature, and of a month at a temperature of 175°C. Step-etch experiments were performed to obtain device physics. It was determined that both the nature of the nitride composition and the oxide layer thickness affected the device characteristics. Author

N69-40411# General Electric Co., Syracuse, N.Y.

DESIGN, DEVELOPMENT, AND FABRICATION OF AN ULTRA HIGH RESOLUTION CATHODE RAY TUBE Final Report, 5 Jan. 1965 - 30 Sep. 1968

K. Schlesinger, E. T. Rate, and E. P. Helinski Feb. 1969 187 p refs

(Contract DA-28-043-AMC-00476(E))

(AD-691752; ECOM-00476-F; Rept-16) Avail: CFSTI CSCL 9/1

The objective was to develop a seven-inch and nine-inch ultra-high-resolution cathode-ray tube capable of delivering 10 microamperes into a spot of 5-microns diameter at the half-intensity points. The tube will utilize spiral focusing lenses, assisted by magnetic focusing, and an FRM electron gun. Author (TAB)

N69-40417# Signals Research and Development Establishment Christchurch (England).

AN INVESTIGATION OF THE TRIMMING OF NICKEL CHROMIUM FILM RESISTORS BY DIAMOND TIP ULTRASONIC SCRIBING

S. K. Archer Nov. 1968 13 p

(AD-691704; SRDE-69003) Avail: CFSTI CSCL 9/1

The report describes the development of a method for the accurate adjustment of thin film resistors to predetermined values. Diamond tip ultrasonic scribing techniques are outlined and experimental results are discussed showing how the wear on the tool tip may be utilized to produce high quality cuts. A comparison of diamond scribing, spark erosion and Laser cutting is made; each method is illustrated by scanning electron micrographs. Author (TAB)

N69-40431# Iowa Univ., Iowa City.

DIAGNOSIS OF ONE BINARY RAIL CASCADES: A SEMIGROUP APPROACH

Giuseppe Fantauzzi Jul. 1969 33 p

(Contract N00014-68-A-0500)

(AD-691755; TR-12) Avail: CFSTI CSCL 9/5

The diagnosis of one-rail cascades is studied here by making use of some simple results of Semigroup Theory. The problem is studied without any limiting hypothesis about the nature of the faults in the array. The two cases are separately studied when at most one cell can be faulty in the array and when any number of cells can be faulty. In the former case a method is given producing the greatest amount of information about fault location and identification. In the more general case, an algorithm is shown which establishes whether or not the cascade is behaving properly. All these results have been obtained by using only the suggested semigroup model. Author (TAB)

N69-40509# Danish Research Centre for Applied Electronics, Copenhagen.

ELECTROLYTIC CAPACITOR TESTS: LIFE AND NONDESTRUCTIVE TESTS FOR LOW AND HIGH VOLTAGE TYPES [UNDERSOGELSE AF AL-ELEKTROLYTKONDENSATORER. LEVETIDSPROVER OG IKKE-DESTRUKTIVE PROVER FOR ET ANTAL FABRIKATER OF HOJ-OG LAV-VOLTTYPER]

A. Norballe and S.T.Olesen Dec. 1968 47 p In DANISH; ENGLISH summary

(ECR-04) Avail: CFSTI

A test of wet aluminum electrolytic capacitors is presented. Twenty-one different low and high voltage types were tested. The purpose was to estimate the quality of the various types and to gain experience concerning quality tests and methods of income inspection for electrolytic capacitors in general. Nondestructive tests were carried out to determine methods of quality control and the test is finished by a number of endurance tests with durations up to 5400 hours. The test has resulted in the quality estimation of the various types in drawing some conclusions concerning control and test methods. Author

N69-40583# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.

CROSSMODULATION IN TRAVELING WAVE TUBES

J. I. Lindstrom and O. Nilsson 1 Nov. 1968 42 p refs

(Contract AF 61(052)-890)

(AD-691015; RADC-TR-69-182; RR-86) Avail: CFSTI CSCL 9/1

Measurements of crossmodulation effects in a commercial medium power S-band TWT are reported. The tube was fed with two simultaneous monochromatic input signals of frequencies 2.15 and 3.80 GHz. The relations between the crossmodulation and the nonlinear distortion with only one of the signals present are investigated and are found to be in very good agreement with a theoretical analysis. For the two signal case the nonlinear amplitude and phase distortions in various representations (compression, AM-to-PM crossconversion etc.) are given as functions of parameters like the helix voltage and the output power. It is confirmed that a low helix voltage gives low AM-to-PM conversion and low AM-to-PM crossconversion, while a high helix voltage gives a good amplitude linearity, i.e. low compression and amplitude crossmodulation. Author (TAB)

N69-40589# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.

BIBLIOGRAPHIC DISCUSSION ON THE PHYSICO-CHEMICAL BEHAVIOUR AND THE RADIO-ECOLOGY OF ZIRCONIUM IN HYDROBIOLOGICAL SYSTEMS [DISCUSSION BIBLIOGRAPHIQUE SUR LE COMPORTEMENT PHYSICO-CHIMIQUE ET LA RADIOECOLOGIE DU ZIRCONIUM DANS LES SYSTEMES HYDROBIOLOGIQUES]

Robert Bittel Jul. 1969 58 p refs In FRENCH; ENGLISH summary

(Contracts EURATOM-003-63-10-PSAF; CEA-4112-r)

(CEA-BIB-159; EUR-4129-f) Avail: CFSTI

The present report forms part of the investigations relating to the behaviour of radionuclides with a complex physico-chemistry, and whose fate, in the hydrobiological systems, can vary according to the combinations in which they are included and the physico-chemical conditions of the environment. The first part is devoted to the physico-chemical aspects. As in the previous reports dealing with ruthenium, cobalt, and lanthanides, particular stress has been laid on zirconium complexes with different mineral or organic compounds present in waste and waste-water; particularly those with different compounds of great biochemical importance. Analytical techniques which can be used in tracer chemistry and in radiochemistry are treated in detail. The second part deals with different aspects of the behaviour of zirconium in water and soils. Zirconium appears to be an easily hydrolizable element inclined to take colloidal and particle forms, so having tendency to fix itself on solid phases while in touch with water (soil and sediments) which limits the importance of the phenomena of chelation and absorption by organisms. Consequently the risk of contamination of the aquatic foodchains of man by zirconium are quite low, compared to the risk arising from the accumulation of this element by soil, clay and mud. Author (ESRO)

N69-40791# Tracor, Inc., New York
RF PERFORMANCE EVALUATION OF SODIUM CONDUCTORS
R. S. Hartman and R. Gardner. 15 Mar. 1969. 62 p. refs
(Contract N00014-67-C-0463)
(AD-691825; NYL-69-8) Avail: CFSTI CSCL 9/5

This report presents test results of a program undertaken by the Naval Research Laboratory to evaluate the performance of sodium conductors used in HF antenna ground planes. The results are also applicable to VLF and LF antennas. This work was stimulated by the recent development of inexpensive sodium conductors for commercial power distribution. The objectives of the test program were to determine the suitability of using sodium conductors in the place of the more conventional copper conductors for large scale antenna ground plane installations used by the Navy. Author (TAB)

N69-40828# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE SIMULATION OF CIRCUIT DIAGRAMS ON GENERAL-PURPOSE ANALOG COMPUTERS
V. V. Aniskov. 28 May 1969. 12 p. refs. Transl. into ENGLISH from Russian Conf.
(AD-692053; FTD-MT-24-125-69) Avail: CFSTI CSCL 9/5

The paper examines the simulation of circuit diagrams on general-purpose analog computers with the aid of operational amplifiers using parallel voltage adders. The simulating circuit of a circuit diagram is obtained by combining the circuits simulating its individual operations, in accordance with the topology of the given circuit diagram. TAB

N69-40850# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
FABRICATION OF SHOCK PRESSURE TRANSDUCERS
R. L. Huddleston and R. E. Sladky. 17 Jul. 1969. 33 p. refs
(Contract W-7405-ENG-26)
(Y-1674) Avail: CFSTI

The strontium, lithium, and calcium transducers, which are the subject of this report, have distinct improvements over the strontium and sodium transducers described in an earlier companion report (Sodium and Strontium Shock Pressure Tranducers, Y-1673). Some of the principal changes from the earlier models are: (1) a very thin sensing grid is vapor deposited on the surface rather than forming a metallic grid, (2) the grid is backed by fused quartz rather than beryllium oxide-loaded epoxy, (3) the connecting pins are made of magnesium rather than copper. Other minor improvements were also made. The changes that were made were intended to improve transducer output, reduce the electrical noise level with respect to the output signal, and improve the shelf life. Author (NSA)

N69-40865# RAND Corp., Santa Monica, Calif.
SIMULATION IN FIELD TESTING
Clifton C. Lovell. Aug. 1969. 14 p. refs
(AD-691862; P-4152) Avail: CFSTI CSCL 14/2

The paper points out some of the demonstrated advantages of using computer simulations on a real-time basis in conjunction with field tests and also suggests the value of designing test oriented simulations as a standard analytical device in the same sense that one would use techniques like multiple regression analysis or analysis of variance. Author (TAB)

N69-40872*# Collins Radio Co., Cedar Rapids, Iowa.
S-BAND POWER AMPLIFIER: IMPROVEMENT PROGRAM Final Report
L. G. Baldwin. [1968] 141 p
(Contract NAS9-8142)
(NASA-CR-101964) Avail: CFSTI CSCL 09E

Two S-band power amplifiers were modified. (1) The Apollo Block 2 engineering model PP-2 was modified primarily in the RF circuitry to determine the feasibility of ferrite circulator switching. (2) NASA amplifier D-1 power supply circuitry was also modified. Results of ferrite switch life tests and RF performance tests of the modified amplifiers are documented along with schematic and reliability data. Further ferrite life testing under extremes of temperature and vibration is proprsed. E.C.

N69-40916# Union Carbide Corp., Oak Ridge, Tenn.
SODIUM AND STRONTIUM SHOCK PRESSURE TRANSDUCERS
R. L. Huddleston and R. E. Sladky. 9 Jul. 1969. 59 p. refs
(Contract W-7405-eng-26)
(Y-1673) Avail: CFSTI

Eight shock pressure transducers which were developed and fabricated at the Oak Ridge Y-12 Plant (four with sodium metal as the pressure-sensitive grid and four with strontium metal) are described. These transducers operate on the principle that significant changes in electrical resistivity occur with changes in pressure. Final shock testing is to be performed at the Lawrence Radiation Laboratory. Author (NSA)

N69-40957# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROCESSES IN A VACUUM ON CLOSING CONTACTS WHICH COMMUTE ACTIVE AND REACTIVE LOADS
S. V. Starodubtsev, M. Yu. Borukhov, S. L. Kel'bert, and R. B. Magaybekov. 2 Jun. 1969. 8 p. refs. Translated into ENGLISH from Ser. Fiz/-Mat. Nauk (Uzbekskoi), no. 1, 1968 p. 44 - 47
(AD-691646; FTD-HT-23-84-69) Avail: CFSTI CSCL 9/1

An investigation of processes occuring on contacts closing in a vacuum of 10 to the -5th power MM Hg was made at a contact-closing frequency of 50 Hz, during the discharge of capacitors of 1400 mf, charged to 160 v. TAB

N69-41064# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THEORY OF ACTIVE NONRECIPROCAL NETWORKS
W. M. Libbey. 4 Feb. 1969. 99 p. refs
(Contract AF 19(628)-5167)
(AD-691435; ESD-TR-69-5, TR-455) Avail: CFSTI CSCL 9/5

The investigation sets forth theory and experimental data for active nonreciprocal networks. A simple way is shown of achieving nonreciprocity using a magnetic field device exhibiting small amounts of differential phase shift. In the theoretical treatment, use is made of scattering parameters. The effect on nonreciprocity of having cascaded and parallel connected elements is considered. How matching and scattering from various junctions influences nonreciprocity is included. Two simple devices exhibiting nonreciprocity are discussed in detail: a differential amplifier, and a differential attenuator; and a procedure is given for their use in active network synthesis. For these devices, the meander line is the nonreciprocal element utilizing a magnetic field. A new meander-line design is presented, realizing a desired impedance, based on recent data on odd- and even-mode velocities along coupled microstrips. From the experimental work, data are reported on a meander line showing impedance characteristics which are in good agreement with theory and showing the amount of differential phase shift possible. To realize an element with loss, an experimental bilateral microstrip attenuator is described whose resistances are short silver-deposited lines. Measurements show satisfactory matching for a 6-dB model. A complete design is given for a microstrip differential attenuator using the loss and nonreciprocal elements mentioned operating near 3 GHz. Scattering parameters measured on a model differential attenuator show very close agreement with theory. Data are presented on both the differential attenuation and the insertion loss of this realized model. Author (TAB)

N69-41066 Missouri Univ., Columbia.
A STUDY OF THE FIELD EFFECT TRANSISTOR ON SEMI-INSULATING GALLIUM ARSENIDE

Wayne Francis DeVilbiss (Ph.D. Thesis) 1968 112 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-3229

Single crystal, chromium-doped gallium arsenide was studied. Its electrical properties and feasibility as a device substrate were determined by using resistivity, Hall Effect, and electrical contacting data. Energy level models for the semi-insulting material were studied. The resistivity of the GaAs is $1.6(10^6)$ ohm-cm. Hall Effect data indicates a bulk electron density of (10^{11}) cm^{-3} and a Hall mobility of 10 – 100 cm^2/V-sec. Insulated gate field effect transistors were fabricated on the surface of the semi-insulting material. Vacuum evaporation and alloy-diffusion were the only processes used during fabrication. The source-drain characteristics of the devices indicates a maximum effective channel mobility of 40 cm^2/V-sec. Capacitance-voltage data show a surface state density of $3(10^{11})$/cm^2-eV. Dissert. Abstr.

N69-41087# Library of Congress, Washington, D.C. Aerospace Technology Div.
DIFFRACTION RADIATION GENERATORS FOR THE MILLIMETER AND SUBMILLIMETER BANDS
Stuart G. Hibben *In its* Foreign Sci. Bull., vol. 5, no. 9 Sep. 1969 p 14-27 refs (See N69-41085 24-34)
Avail: Issuing Activity

Design criteria are reviewed for optimizing the performance of diffraction radiation generators in the millimeter band, and experimental results are discussed. The model treated is based on the orotron configuration, comprising an open resonator having one smooth spherical reflector and one plane reflector with a slotted diffraction grating overlay. Resonant amplitude, Q and power output are recorded as functions of excitation current level and resonator geometry. The results indicate the possibility of extending operation into the submillimeter range. Author

N69-41187*# Westinghouse Electric Corp., Baltimore, Md. Defense and Space Center.
READ-ONLY MEMORIES Final Report
J. R. Cricchi, W. S. Lytle, and D. D. O'Sullivan Jul. 1969 69 p refs
(Contract NAS5-10610)
(NASA-CR-106493) Avail: CFSTI CSCL 09E

The development and use of integrated, complementary MOS read-only memories having nonvolatile and electrically programmable characteristics was investigated. Four-bit CMOS memory cells, using fusible link memory elements in one case and oxide breakthrough memory elements in another were developed. Low-current threshold fusible link elements, having pulse currents of less than 10 mA and current interrupt times of less than 100 μsec, were achieved. A heat flow analysis and repeated evidence of metal migration from the cathode support the theory of thermally accelerated electromigration as a dominant fusing mechanism. Also, oxide breakthrough memory elements, having reproducible breakdown voltages of 20V and linear contact resistance of less than 200 ohms after breakdown, were achieved. Thermal instability is also a factor in the oxide breakthrough elements. The conclusion is that electrically programmable MOS memory cells with either or both of these elements may be integrated as large scale arrays. Author

N69-41207# California Univ., Livermore. Lawrence Radiation Lab.
WIDEBAND ATTENUATION AND PHASE MEASUREMENTS ON HIGH QUALITY COAXIAL CABLES
A. M. Evans and R. L. Rhoads 12 Jun. 1969 13 p refs Presented at Western Electron. Show and Conv., 19-22 Aug. 1969 Sponsored by AEC
(UCRL-71665; Conf-690806-1) Avail: CFSTI

Discrepancies in the skin-effect model for interpreting data acquired via coaxial transmission lines are pointed out, and results of tests of various coaxial cables are presented. Cables tested include those with corrugated conductors, those with smooth cylindrical conductors supported with a helically wound dielectric strip, and one with a braided outer conductor and solid dielectric attenuation and time delay data are presented. An output prediction using laboratory waveshapes is presented and shown to compare to a measured input-output pair. NSA

N69-41208*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
ENERGY DISTRIBUTION OF A SPIRALING ELECTRON BEAM
Bernhard Kulke Washington Nov. 1969 25 p refs
(NASA-TN-D-5490) Avail: CFSTI CSCL 09A

A retarding-field analyzer was used to investigate the energy conversion and the energy spread of a spiraling electron beam, where the trajectory is generated from a magnetic corkscrew-magnetic ramp combination. It was found that in the absence of space-charge effects, a relatively narrow, near rectangular energy distribution will be generated by the corkscrew when the axial magnetic field is tuned to cyclotron resonance. The normalized width of this distribution is approximately independent of the degree of energy conversion, in agreement with the theory, and the mean transverse energy varies as the square of the corkscrew current. The magnetic ramp amplifies both the mean transverse energy and the energy spread linearly. Both these quantities also can be estimated by using the mirroring effect of the magnetic ramp, in conjunction with variable corkscrew current. Author

N69-41236 Saskatchewan Univ., Saskatoon.
MULTIVARIABLE CONTROL OF ELECTRIC GENERATORS
Ronald James Fleming (Ph.D. Thesis) 1968 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-3011

A technique was developed which can be used to analyse the performance of a frequency and voltage controlled electric generator taking into account the inherent cross coupling between the control loops. This technique is based on the fundamental concepts of multivariable control theory. The operating characteristics of the various power system elements are formulated in the multivariable form and the matrix and signal flow graph techniques required for analysis and design are developed by way of specific numerical examples. It is shown that this cross coupling of the frequency and voltage control loops has a significant effect on the regulating performance and that cognizance of this should be taken when the controllers are designed. It is demonstrated that the multivariable control methods can be utilized in this problem to take account of these factors and that they lead to physically realizable controller designs. Dissert. Abstr.

N69-41296# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF SUBHARMONIC RIPPLE IN A FORCED LIMIT-CYCLING REGULATOR
Wilton Hubert Hyde, Jr. (M.S. Thesis) Dec. 1968 100 p refs
(AD-691385) Avail: CFSTI CSCL 9/5

Some Nonlinear Feedback Control Systems under high gain conditions exhibit the phenomenon of subharmonic instability, or contain subharmonics of the fundamental output frequency. A general discussion of subharmonics in nonlinear systems is followed by an investigation of ripple instability in a forced limit-cycling voltage regulator containing a thyristor or SCR bridge utilizing an ON-OFF switching scheme. A digital computer program is used to simulate the dynamic response of the system under different loading conditions and for different reference voltage levels. Author (TAB)

N69-41312 National Lending Library for Science and Technology, Boston Spa (England).
THE ELECTRONIC GONIOMETER [EIN ELEKTRONISCHES GONIOMETER]
Von G. Hoefgen 20 Jul. 1969 13 p refs Transl. into ENGLISH from Frequenz (Berlin), v. 22, no. 2, Feb. 1968 p 32-34 In

ENGLISH and GERMAN
(NLL-M-7737-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

The operational characteristics and design concepts of the electronic goniometer, a device which allows rotation of a high-frequency directional pattern without mechanically moving parts, are discussed in detail. Methods of construction using modern semiconductor techniques are treated, as well as goniometer modulator components based on controlled real resistors and controlled reactance. Optimum realization is found in the separation of modulation and power amplification and in the use of power amplifiers with good limiting characteristics to suppress AM-disturbance components. A.C.R.

N69-41326# Joint Publications Research Service, Washington, D.C.
PAPERS PRESENTED AT IFAC SESSION IN WARSAW
3 Oct. 1969 58 p refs Transl. into ENGLISH of Russian Conf. papers Conf. held 16 - 21 Jun. 1969
(JPRS-48971) Avail: CFSTI

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2. ON THE CONSTRUCTION OF CHECKING TESTS FOR DISCRETE DEVICES WITH DELAY ELEMENTS A. F. Volkov et al p 20 - 31 refs (See N69-41328 24-09)

3. THEORY OF QUESTIONNAIRES AND THE PROBLEMS OF TECHNICAL DIAGNOSTICS P. P. Parkhomenko p 32 - 43 refs (See N69-41329 24-19)

4. NEW ANALOG SIMULATIONS FOR CONTROL PURPOSES L. I. Gutenmakher p 44 - 57 refs (See N69-41330 24-09)

N69-41327# Joint Publications Research Service, Washington, D.C.
A TECHNIQUE FOR CONSTRUCTION OF CHECKING AND DIAGNOSTIC TESTS FOR ALL-PURPOSE UNIFORM ARRAYS
I. V. Prangishvili et al *In its* Papers presented at IFAC Session in Warsaw 3 Oct. 1969 p 1 - 19 refs (See N69-41326 24-09)
Avail: CFSTI

Uniform arrays, a new class of circuits consisting of identical elements interconnected in the same manner and program-tuned to perform the required functions, are identified as one of the most effective means of achieving digital automation and telemechanics, as well as constructing large, integrated-circuit computer devices. The major advantages of uniform, tunable, microelectronic equipment using such circuitry are versatility, low cost, reliability, durability, ease of manufacture, high level of standardization, and high efficiency. Operations checking and defect diagnosis of the array and any terminal automation system using this circuitry is greatly simplified in comparison with checking irregular layouts, since tests need only be constructed for elements of the same type with regular couplings. A.C.R.

N69-41328# Joint Publications Research Service, Washington, D.C.
ON THE CONSTRUCTION OF CHECKING TESTS FOR DISCRETE DEVICES WITH DELAY ELEMENTS
A. F. Volkov et al *In its* Papers presented at IFAC Session in Warsaw 3 Oct. 1969 p 20 - 31 refs (See N69-41326 24-09)
Avail: CFSTI

A unit-type method of constructing a checking test for discrete devices with delay elements is described. The technique is useful, since it satisfies the following considerations: (1) Most of the control system circuitry of digital computers is amenable to such simulation. (2) The transient character of the simulation enables use of the method for combination devices and takes into account the specific character of multicycle devices. (3) The inclusion of other memory elements in the makeup of the devices being checked will not void, but only modify the algorithm being used. A.C.R.

N69-41330# Joint Publications Research Center, Washington, D.C.
NEW ANALOG SIMULATIONS FOR CONTROL PURPOSES
L. I. Gutenmakher *In its* Papers presented at IFAC Session in Warsaw 3 Oct. 1969 p 44 - 57 refs (See N69-41326 24-09)
Avail: CFSTI

A simulation method is suggested that enables problem solution on the basis of transient processes in electric circuits containing capacitors and pulse current transformers in addition to the diodes and resistors. In this case, object simulation is not static, but dynamic; the solution of each problem is obtained in the form of a series of instantaneous current and voltage values during the transient process. A.C.R.

N69-41345# Technische Hogeschool, Eindhoven (Netherlands).
ELECTRONIC CONTROL OF ELECTROMECHANICAL ENERGY CONVERSION IN ELECTRICAL MACHINES
Jacobus Daniel Van Wyk (Ph.D. Thesis) 1969 388 p refs
Avail: CFSTI

An investigation is conducted into the control of electromechanical energy conversion on power flow principles. An attempt is made to approach the subject as generally feasible, in order to develop a theory for these types of systems. A group of the general systems is selected for further theoretical investigation. Examples of these machine electronic systems have been developed and investigated experimentally in order to establish the validity of the theoretical approaches developed. Author

N69-41350# California Univ., Berkeley. Lawrence Radiation Lab.
SEMICONDUCTOR VARIABLE DELAY ELEMENTS
Rory Lynn Van Tuyl (M.S. Thesis) Dec. 1968 83 p refs
(Contract W-7405-Eng-48)
(PB-183639; UCRL-18668) Avail: CFSTI CSCL 09A

This paper is concerned with electronic devices which exhibit the property of controllable signal propagation delay based on the principle of minority carrier drift in semiconductors. Theoretical predictions of the time domain response of ideal devices are compared to measurements made on a practical device fabricated with the gaseous diffusion techniques used in the manufacture of integrated circuits. The theoretical aspects of temperature compensation are discussed, and successful temperature compensation of a device is reported. Application of devices to time delay, phase-shift, frequency selective filter, and oscillator circuits are presented, and the course of future work, leading to more sophisticated applications is outlined. Author (USGRDR)

N69-41367# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTROMAGNETIC DEVICES OF AUTOMATION, VOLUME 1
Ye. I. Yurevich 9 Dec. 1968 260 p Transl. into ENGLISH of the book "Elektromagnitnyye Ustroystva Avtomatiki," vol. 1 Moscow, Izd. Energiya, 1964 p 1 - 399
(AD-691151; FTD-HT-23-526-67-Vol-1) Avail: CFSTI CSCL 9/1

This book describes the operating principles and cites the fundamentals in the design of electromagnetic automation equipment. In addition to the basic electromagnetic elements, discrete action ferromagnetic equipment, magnetic amplifiers, special magnetic elements of digital mathematical equipment, magnetic generators and frequency converters, voltage and current stabilizers, elements using the hall effect and magnetic resistance, dielectric amplifiers and relays are examined. Contents: neutral electromagnets; polarized electromagnets; electromechanical clutches; electromechanical relays and contactors; principle of operation and

basic properties of magnetic amplifiers; nonreversible magnetic amplifiers without feedback; and nonreversible magnetic amplifiers with feedback. TAB

N69-41368# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTROMAGNETIC DEVICES OF AUTOMATION, VOLUME 2
Ye. I. Yurevich 9 Dec. 1968 267 p refs Transl. into ENGLISH of the book "Elektromagnitnyye Ustroystva Avtomatiki," vol. 2 Moscow, Izd. Energiya, 1964 p 399-519
(AD-691155; FTD-HT-23-526-67-Vol-2) Avail: CFSTI CSCL 9/1

Contents: Reversible magnetic amplifiers; Multistage magnetic and mixed amplifiers; The design of magnetic amplifiers; Ferromagnetic devices of discrete operation; Special ferromagnetic devices of digital computers; Ferromagnetic frequency generators and converters; and Dielectric devices. TAB

10 ELECTRONICS

Includes circuit theory, and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N69-40094 National Lending Library for Science and Technology, Boston Spa (England).
THE PROBLEMS OF THE CONNEXION NETWORK IN TIME-DIVISION SWITCHING
F. Tallegas 1 May 1969 27 p refs Transl. into ENGLISH from Commutation et Electronique (France), no. 23, Oct. 1968 p 43-57
(NLL-PORS-Trans-2553-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The two types of switching networks described are not absolutely fixed in structure or technology, and may be divided into two groups: blocking and nonblocking. In blocking networks consisting of two basic units of 32 network lines, where two lines are reserved for the supplementary circuits in each basic unit, a total of 60 network lines of 31 time-division channels remains. This can provide tandem exchanges with up to 1860 circuits or local (urban) exchanges with up to 620 circuits and 10,000 subscribers by time-division switching. Blocking networks consisting of a basic range of 30 network lines may provide tandem centers with a minimum of 930 circuits and local centers with a minimum of 310 circuits and 5000 subscribers. R.B.

N69-40195 Michigan Univ., Ann Arbor.
NETWORK FUNCTION DETERMINATION FROM PARTIAL SPECIFICATIONS
Arthur Rechtman Braun (Ph.D. Thesis) 1968 70 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-2291

In certain problems of network theory the real and imaginary parts of a driving-point impedance function may be independently given in a band of interest ($\omega_1 \leq \omega \leq \omega_2$), leaving its continuations onto ($0 \leq \omega \leq \omega_1$) and ($\omega_2 \leq \omega \leq \infty$) completely unspecified. By manipulating the Hilbert Transforms, relating the real and imaginary parts of a function of a complex variable ($p = \sigma + j\omega$) having no poles on the $j\omega$ axis or in the right-half plane, this thesis shows that if the continuations exist they are unique and readily obtained. Three necessary conditions for the existence of the continuations to the given parts (of the driving-point impedance function) are obtained. If these three conditions are satisfied the continuations may be obtained as a Fourier series. Four known impedances were used as examples and their continuations determined. The results obtained were excellent. Dissert. Abstr.

N69-40382# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
NONLINEAR MICROWAVE TUBE PHYSICS Final Report
Sven Olving Dec. 1968 16 p refs
(Contract AF 61(052)-890)
(AD-691082; RADC-TR-69-89) Avail: CFSTI CSCL 9/1

A large signal analytical theory for klystron current waves has been worked out. The theory in effect bridges the gap between the Hahn-Ramo type small signal space charge wave theory and Webster's very large signal ballistic theory. The third order theory also describes the high order harmonics, e.g. the fifth harmonic, correctly. A computer analysis of large signal waves, based on an analytic method to account for the electronic forces, has also been carried out. A variety of beam geometries has been considered. An extensive computer analysis of the large signal traveling wave tube is presented. Again the computer program utilizes earlier analytical results. The results describe amplitude and phase nonlinearities and saturation phenomena. Cross modulation and intermodulation with an arbitrary number of carriers in a limited frequency band is studied analytically. Cross modulation between two widely separated carriers has been measured and found to be in good agreement with an earlier theory. Earlier work in connection with slow wave structures for traveling wave tubes revealed that basic electromagnetic field formulae had to be revised when the propagation medium was spatially dispersive. The present work applies the new results on the case of ferromagnetic media. Author (TAB)

N69-40438*# Sperry Rand Research Center, Sudbury, Mass.
INVESTIGATION OF NEW CONCEPTS OF ADAPTIVE DEVICES Quarterly Technical Report, 3 Mar. - 2 Jun. 1969
F. Lewis, F. Sewell, and H. A. R. Wegener Jun. 1969 19 p
(Contract NAS12-570)
(NASA-CR-86255; SRRC-CR-69-16; QTR-7) Avail: CFSTI CSCL 09C

The decay processes of a distributed charge of positive polarity and of a charge sheet are analyzed for a memory structure with well-defined interface before and after the application of a negative charging voltage. A charging process consisting of the establishment of a positive charge distribution resulting from the charge transfer rates is considered in a mathematical description of the decay in the gate structure of a memory device. A new metal nitride semiconductor/variable threshold transistor is described which is used as a light-sensitive memory element to detect and store an optical signal. This device is operated in the write mode, with the source and drain unconnected. The write voltage is partially dropped across a silicon space charge region whose magnitude can be controlled by varying the illumination incident upon the device. K.W.

N69-40899# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
AN INTRODUCTION TO THE DESCRIPTION AND EVALUATION OF MICROWAVE SYSTEMS USING TERMINAL INVARIANT PARAMETERS
Glenn F. Engen Oct. 1969 29 p refs
(NBS-Monograph-112) Avail: SOD $0.35

The description and evaluation of microwave systems is usually by means of microwave circuit analysis, which may be regarded as an extension of the practice at lower frequencies. In order to insure its validity, it is necessary to postulate that the different components, which comprise the microwave system, are interconnected via uniform and lossless waveguide, and which is usually restricted to single mode operation. As a consequence, precision waveguide and connectors are usually considered necessary elements for an accurate experimental evaluation of a microwave system. It is possible to avoid this requirement in an alternative formulation where the description is based upon net power, instead of the complex traveling wave amplitudes. In this reformulation the basic parameters include available power, maximum efficiency (or intrinsic attenuation), and several different mismatch factors. The important feature of these parameters is their terminal invariant

property, and their invariance to an arbitrary shift in the terminal reference surface. In this way the precision waveguide and connector requirement is avoided for an important class of measurement problems. In addition the physical model, upon which the description is based, is a simple one which provides improved insight into mismatch errors and corrections. Author

N69-41228# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON A DIFFERENTIAL LAW FOR THE INTENSITY OF ELECTRICAL FLUCTUATIONS AND THE INFLUENCE OF SKIN-EFFECT THEREON
M. A. Leontovich et al [1968] 8 p refs Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz. (Moscow), v. 23, no. 3(9), 1952 p 246 - 252
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The form of the correlation function of the secondary electric field due to the integrated emf of thermal electrical fluctuations whose spectral intensity is given by the Nyquist law is presented under a quasi-stationary condition. An expression is obtained for the integrated emf due to an arbitrarily distributed secondary field over the volume of the conductor for a frequency ω, satisfying the quasi-stationary condition. It is shown that for the spectral intensity of an integrated random emf proportional to the active resistance of the conductor, it is sufficient to assume that the radius of correlation α of the secondary field is small when compared with the radius of the conductor a and with the thickness of the skin layer d. R.B.

N69-41371 National Lending Library for Science and Technology, Boston Spa (England).
HYBRID NETWORKS IN THICK LAYER AND THIN LAYER TECHNIQUES
F. J. Muehe et al 21 May 1969 11 p Transl. into ENGLISH from Stemag Nachr. (Ger.), no. 41, Apr. 1968 p 1136 - 1139
(NLL-PORS-Trans-2556-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

Integrated network construction by the simultaneous building in layers of as many network elements as possible is discussed. Thin layer and thick layer hybrid techniques are described. F.O.S.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N69-40190# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
THE HOT ISOSTATIC PRESSING EXPERIMENT OF THE OAK RIDGE Y-12 PLANT
A. C. Neeley, W. A. Pfeiler, and C. K. Valentine 18 Jul. 1969 15 p
(Contract W-7405-ENG-26)
(Y-1683) Avail: CFSTI

Approved designs of hot-gas autoclaves previously used the principle of minimizing gas convection currents. The hot isostatic pressing facility at the Oad Ridge Y-12 Plant is designed so that convection currents are maximized in the contained vessel. Argon is used to enhance this effect. Author (NSA)

N69-40408# RAND Corp., Santa Monica, Calif.
MARGINAL COST PRICING OF AIRPORT RUNWAY CAPACITY
Alan Carlin and Rolla Edward Park Aug. 1969 29 p refs
(AD-691861; P-4134) Avail: CFSTI CSCL 1/5

The report explores the possibility of relieving the congestion and optimizing the use of airport runways by imposing marginal cost pricing or congestion tolls. Other short-term solutions are only briefly considered. New Yorks LaGuardia Airport is used as the primary example. It is concluded that proportional marginal cost pricing is preferable on efficiency grounds to the present weight-based service pricing used at most airports. Carrier load factors would have to be increased to more efficient levels by administrative measures. TAB

N69-40414# RAND Corp., Santa Monica, Calif.
A MODEL OF LONG DELAYS AT BUSY AIRPORTS
Alan Carlin and Rolla Edward Park Aug. 1969 36 p
(AD-691860; P-4126) Avail: CFSTI CSCL 1/5

In this paper, a model of long delays at busy airports is sketched. The primary purpose is to provide a tool to assist in evaluating the benefits, in terms of reduced delay, of any policy to limit traffic. Along the way, an improved method of estimating delay patterns is outlined, and traffic and delay estimates for Kennedy arrivals are presented. As an illustration, the model is fitted for Kennedy arrivals. Section I presents the simple theoretical formulation of our model. Section II develops empirical estimates of traffic and delays that are needed to fit the model to Kennedy arrivals. In Section III, the procedure used to fit the model is outlined. Some results on delay reductions to be expected given specified traffic reductions are summarized in Section IV. Author (TAB)

N69-40594*# Techtran Corp., Glen Burnie, Md.
LABORATORY OF AEROSPACE MEDICINE [LABORATOIRE DE MEDECINE AEROSPATIALE]
Washington NASA Sep. 1969 67 p Transl. into ENGLISH from French paper
(Contract NASw-1695)
(NASA-TT-F-12462) Avail: CFSTI CSCL 14B

This paper is a profusely illustrated description of the personnel, facilities and test program of the French Laboratory for Aerospace Medicine, written on a popular (Public Relations) level. Author

N69-40597# National Physical Lab., Teddington (England). Aerodynamics Div.
EUROPEAN HYPERSONIC RESEARCH: EXPERIMENTAL FACILITIES
E. W. E. Rogers ed. Nov. 1968 49 p In FRENCH, GERMAN, and ENGLISH
(NPL-AERO-SR-029; ARC-30763) Copyright. Avail: CFSTI

Hypersonic aerodynamic facilities in Belgium, France, Germany, Italy, the Netherlands, Sweden and the United Kingdom are presented and the characteristics and potential of the existing experimental equipment are listed in a uniform manner with a page for each installation. Author (ESRO)

N69-40600# National Physical Lab., Teddington (England). Aerodynamics Div.
ON THE USE OF ORIFICE PLATES IN SHOCK AND GUN TUNNELS
L. Davies, D. R. Brown (Univ. Coll. of Wales) and G. Hooper (Univ. Coll. of Wales) 5 Nov. 1968 9 p refs
(NPL-AERO-NOTE-1076; ARC-30656) Copyright. Avail: CFSTI

The driver-reservoir technique is employed to eliminate the reflected head of the expansion wave, leading to a significant increase in running time. The running time is then potentially limited by the reflected primary shock (shock tunnel), or by the shock or when the piston slows to rest (in the gun tunnel). These waves can be eliminated by the use of orifice plates, and the technique, together with some illustrative experiments, is described in this paper. Author (ESRO)

N69-40713# British Airports Authority, London (England).
THE AIRPORT AND AUTOMATION

J. D. Perret. *In* Brit. Air Line Pilots Assoc. Automation, Simulation and Data Handling in Civil Aviation 1968 p 155-161 (See N69-40702 24-02)
Avail: CFSTI

Probable developments in airport automation in the near future are discussed. Since forecasts indicate the rapidly continuing increase in civil air traffic, a requirement exists for a fully automated ground detection, guidance, and control system to insure high efficiency regardless of weather conditions and other external influences. The problem centers on reducing the work load of air traffic controllers and operations on the flight deck. Outline specifications for an automated system to reach this goal include: (1) aircraft detection and identification; (2) guidance on the taxiway; (3) control tower display; and (4) conflict protection, manual control override capability, and fail-safe procedures. Equipment currently available for use in these areas is evaluated, and problems in the man-machine interface and management of an automated system for dealing with highly complex traffic problems are discussed. Simulation techniques for all aspects of airport operation are briefly treated, with emphasis on demand prediction for controlling both terminal conditions and those in nearby airspace. A.C.R.

N69-40728# Interim Communications Satellite Committee.
PERFORMANCE CHARACTERISTICS OF EARTH STATIONS
31 Jan. 1969 40 p
(ICSC-37-38E-W/1/69) Avail: CFSTI

The responsibilities of the Interim Committe are outlined, and a specification is presented which covers all aspects of the general performance characteristics of an earth station suitable for operation with Intelsat satellites. The typical performance characteristics of a lower sensitivity earth station are also given. The effect of local climatic conditions on the quality of service is discussed in order that an applicant may determine whether his earth station will need to have performace characteristics superior to the standard. The mandatory technical characteristics of a standard earth station, which are required before an earth station will be permitted to utilize the space segment, are defined. It is pointed out that the use of nonstandard earth stations with performance characteristics lower than those specified will be considered on an individual basis; however, an earth station which does not meet the mandatory requirements may attract additional units of utilization and higher space segment charges. M.G.J.

N69-40974# Battelle-Northwest Lab., Richland, Wash. Pacific Northwest Lab.
PRELIMINARY FAULT TREE ANALYSIS FOR THE FFTF
M. A. McLaughlin. May 1969 37 p refs
(Contract AT(45-1)-1830)
(BNWL-874) Avail: CFSTI

A preliminary fault tree analysis for the Fast Flux Test Facility is presented. The fault tree is a logic diagram showing all possible failures leading to the FFTF postulated maximum accident, release of radioactivity outside the containment. Probabilities of occurrence of the failure sequences were not calculated due to the preliminary state of the system design. It is concluded that the design of the FFTF safety lsystem meets the established criteria in that multiple simultaneous faults are required to allow anything more serious than a minor accident. Author (NSA)

N69-41222 Arizona Univ., Tucson.
STEWARD OBSERVATORY AND THE DEPARTMENT OF ASTRONOMY Annual Report, 1 Oct. 1968 - 30 Sep. 1969
Bart J. Bok 30 Sep. 1969 29 p refs
Avail: Issuing Activity

Installation and test operation of the 90-inch reflector and the auxiliary equipment at the Kitt Peak station are briefly described. The faint signal detection program, the thin films program, evaluation of aspheric optics, and development of an image dissector tube for the 90-inch telescope are mentioned. Current research projects are summarized, the most important of which are concerned with the discovery and identification of the first optical pulsar in the Crab Nebula, theoretical studies of the galaxies, problems of interstellar matter, the spiral structure of the Milky Way, star clusters, and supernova remnants. K.W.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N69-40028*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CHEMICALLY REACTING COUETTE FLOW WITH HYDROGEN INJECTION FOR TWO DIFFUSION MODELS
Randolph A. Graves, Jr. (M.S. Thesis - Va. Polytech. Inst.) Jun. 1969 104 p refs
(NASA-TM-X-61899) Avail: CFSTI CSCL 20D

This investigation deals with an analytical study of the effects of hydrogen injection and chemical reaction on the flow properties of Couette flow with special emphasis given the diffusion model assumed for the calculations. The two diffusion models chosen are Fick's law diffusion and multicomponent diffusion. Solutions to the governing equations for Couette flow were obtained for the two diffusion models over a range of hydrogen injection rates. The results indicate that there are significant differences between the solutions for the two diffusion models and these differences are manifested most in the concentration profiles and the lower wall heating rates. Author

N69-40092# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STEADY-STATE FLOW IN THIN FILMS
L. V. Pashinina 24 Jan. 1969 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk, Mekhan. Zhidkosti i Gaza (USSR), no. 3, 1966 p 80-84
(AD-692188; FTD-HT-23-1091-68) Avail: CFSTI CSCL 20/4

A steady motion of a thin layer of viscous fluid bounded by the surface of rigid body from one side and by moving gas from the other side is considered. The free surface of the layer is assumed in a wave form. Navier-Stokes' equations, after introducing a stream function and linearization, are reduced to an ordinary fourth-order differential equation, which is solved. In the linear case, the velocity of propagation of longitudinal waves is independent of the wavelength. The nonlinear case is treated with the small parameter method and the solution gives the relations between the wavelength and the velocity of propagation and the amplitude. Author (TAB)

N69-40117# National Physical Lab., Teddington (England). Aerodynamics Div.
A NOTE ON THE 'LAW OF THE WALL' FOR TEMPERATURE
P. Bradshaw May 1969 10 p refs
(NPL-AERO-NOTE-1080; ARC-31259) Copyright. Avail: CFSTI

The temperature profile derived from the mixing length formula, assuming a linearly-varying shear stress and heat flux, is compatible with data presented by Head. The use of unverified assumptions about the turbulent Prandtl number in the sublayer is held to be less convenient than the insertion of constants of integration in the velocity and temperature profiles. Author (ESRO)

N69-40127*# Wyle Labs., Inc., Huntsville, Ala. Research Div.
CHARACTERISTICS OF THE STATIC AND FLUCTUATING PRESSURE ENVIRONMENTS INDUCED BY THREE-DIMENSIONAL PROTUBERANCES AT TRANSONIC MACH NUMBERS

J. E. Robertson Jun. 1969 255 p refs
(Contract NAS8-21026)
(NASA-CR-102269; WR-69-3) Avail: CFSTI CSCL 20D

A wind tunnel investigation was conducted to study the flow field induced by three-dimensional protuberances at transonic Mach numbers. The perturbed flow environments of both the protuberances and the surrounding structure were analyzed utilizing static- and fluctuating-pressure measurements and oil-flow visualization techniques. Test results for the generalized configurations which consisted of 2-, 4-, and 8-inch diameter cylindrical protuberances are discussed herein. The range of test variables consisted of protuberance heights from zero to 2 diameters, free-stream Mach numbers from 0.60 to 1.60, and unit Reynolds numbers from 1.5 to 4.5 million per foot. From the static- and fluctuating-pressure measurements and the oil-flow patterns, the structure of the perturbed flow field has been defined. One of the most significant findings is that the upstream separated flow field induced by three-dimensional protuberances consists of a complex, multiple vortex system which generates fluctuating pressures an order of magnitude greater than those observed in two-dimensional separated flows. The extreme fluctuating pressures encountered within the three-dimensional separated flow field are attributed to the shear interaction of two major vortices within the separated region. Author

N69-40133# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

SPECTRA OF INTERNAL WAVES AND TURBULENCE IN STRATIFIED FLUIDS. PART 2: EXPERIMENTS ON THE BREAKING OF INTERNAL WAVES IN A TWO-FLUID SYSTEM

J. Michael Hall and Yih-Ho Pao Jun. 1969 15 p refs Presented at URSI/IUCRM Colloq. on Spectra of Meteorol. Variables, Stockholm, 9-19 Jun. 1969
(AD-691360; D1-82-0860) Avail: CFSTI CSCL 8/3

The breaking of internal waves on a sloping surface in a two-fluid system is studied experimentally in a wave tank. The characteristics of breaking internal waves are examined through their frequency spectra for cases of different frequency, amplitude, and wavelength. Wave height measurements are made with capacitance probes in conjunction with a recently developed capacitance bridge and are processed by computer utilizing the Cooley-Tukey fast Fourier transform algorithm. Use of a direct, on-line computer system enables spectra to be computed with a high degree of accuracy and a very narrow bandwidth. Spectra measured in the breaking region of the tank reveal a series of sharp peaks in the low frequency range representing the different harmonics of the internal waves. These higher modes, which possess little or no energy in the incident wave, gain energy at the expense of the lowest mode as the wave train propagates over the sloping surface. The result is a transfer of energy to higher frequencies through growth of the harmonics, each gaining energy at the expense of lower modes and transferring it to higher modes. At higher frequencies, the spectra no longer possess these distinct harmonics. The high frequency end of the spectrum in the breaking region has a slope of approximately -3 for all cases considered. Author (TAB)

N69-40137*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FLUCTUATING PROPERTIES OF TURBULENT BOUNDARY LAYERS FOR MACH NUMBERS UP TO 9

William D. Harvey, Dennis M. Bushnell, and Ivan E. Beckwith Washington Oct. 1969 51 p refs
(NASA-TN-D-5496) Avail: CFSTI CSCL 20D

Estimates of the variation in intensity of the longitudinal velocity fluctuations across hypersonic turbulent boundary layers at Mach numbers from 8.2 to 8.9 were made. These estimates were based on experimental measurements of fluctuating density and pitot pressure in the nozzle-wall boundary layer of a shock tunnel. Also, it is shown that reasonable estimates of the root-mean-square values of the fluctuating velocity, density, and temperature for Mach numbers from 1.72 to 8.9 can be made by using a mixing-length approach. Comparison with previous experimental data indicate that the intensity of these fluctuating quantities, expressed in terms of suitable normalizing parameters, may be essentially independent of Mach number up to about Mach 9. Author

N69-40146# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIMENTAL STUDY OF BOUNDARY-LAYER CONTROL BY BLOWING ON A FLAT PLATE FOR M EQUALS 2.5

V. T. Grin 3 Feb. 1969 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. Zhidkosti i Gaza (USSR), no. 6, 1967 p 115-117
(AD-692185; FTD-HT-23-611-68) Avail: CFSTI CSCL 20/4

An experimental investigation of boundary layer control by the injection of gas through a two-dimensional slit in the region of shock wave-boundary layer interaction was carried out in wind tunnel with a closed test section. A gas is injected into a boundary layer in the direction of free flow. The experimental setup and measuring techniques are described briefly. The analysis of the experimental results shows that boundary layer control by gas injection makes it possible to raise the resistance of the boundary layer to separation, and that this may be achieved with a small expenditure of injected gas. Author (TAB)

N69-40168 Oklahoma Univ., Norman.

HYDRODYNAMIC STUDY OF LIQUID-LIQUID SEPARATION IN A CONVENTIONAL CYCLONE

Henry Pa-Houng Sheng (Ph.D. Thesis) 1968 205 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-17597

A mathematical model postulating a combined streamline flow and centrifugal action is proposed. However, by testing against the processed experimental data, it is discovered that only at phase ratio (oil/water) of 1/2, the streamline flow governs the mechanics of phase separation. In this respect, the fate of a solid or liquid to exit in the overflow is ultimately determined by its path and the momentum of the air core relative to the terminal velocity of the particle in question. The prevalent assumption, which attributes the centrifugal action to be the sole controlling factor in a cyclone, is therefore not adequate for a liquid-liquid system. Unlike the common centrifuge which draws on external power for the separation of phases, the source of power in a hydrocyclone is inherent within the system. Consequently, the separation in a hydrocyclone is inevitably complemented by a degree of turbulence. Through the theoretical formulation outlined in this thesis, it is possible to express the macroscopic turbulent length in a dimensional form. Dissert. Abstr.

N69-40200*# Nielsen Engineering and Research, Inc., Palo Alto, Calif.

THEORETICAL STUDY OF VORTEX SHEDDING FROM BODIES OF REVOLUTION UNDERGOING CONING MOTION

Gary D. Kuhn, Selden B. Spangler, and Jack N. Nielsen Washington NASA Oct. 1969 61 p refs
(Contract NAS2-4765)
(NASA-CR-1448; NEAR-TR-14) Avail: CFSTI CSCL 20D

Based on experimental evidence of the existence of a steady asymmetric vortex system on a slender body in coning motion, a theoretical flow model for vortex shedding was developed using potential flow methods and slender-body theory. The model provides for the calculation of the strength and position of each of the two vortices representing the areas of concentrated vorticity in the crossflow plane and the resulting force distribution induced on the body. Initial vortex locations very close to the body must be prescribed to start the computation. The flow model developed is felt to describe reasonably accurately the nature of the vortex-like separated flow over the body and the vortex-induced force distribution. Author

N69-40204*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EXPERIMENTAL INVESTIGATION ON UNIT REYNOLDS NUMBER AND BLUNTNESS EFFECTS ON BOUNDARY-LAYER TRANSITION FOR A 10 DEG HALF-ANGLE CONE AT M INFINITY EQUALS 7
Michael Carlton Fischer (M.S. Thesis - Va. Polytech. Inst.) Jun. 1969 100 p refs
(NASA-TM-X-61906) Avail: CFSTI CSCL 20D

An experimental investigation was made of the effect of unit Reynolds number and nose bluntness on the transition Reynolds number for a 10° half-angle cone. The tests were conducted at a nominal Mach number of 7 and the free-stream unit Reynolds number was varied from 1.88×10^6 to 6.21×10^6 per foot. The results showed a significant influence of local unit Reynolds number on transition for the sharp cone. A comparison of data from various facilities on sharp slender cones indicated the presence of unit Reynolds number effects as well as the effect of local Mach number on transition. The present transition data were compared to a correlation based on tunnel noise parameters which showed that radiated tunnel aerodynamic noise had a major influence on the present results. Correlations of the effect of local Mach number on the transition Reynolds number at similar local unit Reynolds numbers are presented. The effect of bluntness was to reduce the local Reynolds number and displace transition rearward completely off the cone surface. Author

N69-40224# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
FLUID LOGIC [LA LOGIQUE A FLUIDE]
René Lancon (Ph.D. Thesis) Jun. 1969 37 p refs In FRENCH; ENGLISH summary
(CEA-BIB-165) Avail: CFSTI

Fluid logic uses a liquid or a gas for transmitting information and fluidic devices capable of performing the elementary operations of binary logic are described. The dynamic elements use the movement or deformation of a mechanical piece to command fluid pressure or flow whilst the static elements use the interaction between two fluid streams or between a stream and a wall. The performances of such elements and their main applications are reviewed and though not as fast as electronic devices, fluid logic elements are economic and have a very high reliability. Author (ESRO)

N69-40236# National Physical Lab., Teddington (England). Aerodynamics Div.
THE FLOW INDUCED OSCILLATIONS OF PILES
L. R. Wootton, R. N. Sainsbury (John Mowlem and Co., Ltd.), M. H. Warner (Brit. Transport Docks Board Res. Sta.), and D. H. Cooper (Brit. Transport Docks Board Res. Sta.) Jan. 1969 22 p refs
(NPL-AERO-SR-025) Copyright Avail: CFSTI

Vortex induced oscillations in line with the direction of the flow (due to a fluctuating drag force) are discussed. Some preliminary results of these oscillations on a full scale jetty in an estuary and proposals for further work are presented. Author (ESRO)

N69-40267# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
FORCED CONVECTION OF AMMONIA. PART 2: GASEOUS AMMONIA, VERY HIGH WALL TEMPERATURES (1000 TO 3000°K) [CONVECTION FORCEE DE L'AMMONIAC. DEUXIEME PARTIE: AMMONIAC GAZEUX, CAS DE TRES HAUTES TEMPERATURES DE PAROI (1000 A 3000°K)]
Paul Perroud, Jean Rebiere, and Rolf Strittmatter Jun. 1969 120 p refs In FRENCH; ENGLISH summary Prepared jointly with Direc. des Rech. et Moyens d'Essais
(CEA-R-3728) Avail: CFSTI

The heat transfer coefficients and pressure drop of gaseous ammonia in forced convection were experimentally determined with the gas flowing (mass flow rate 0.6 to 2.4 g/s; G = 10-40 $g/cm^2 \cdot s$) in a long electrically heated tungsten tube (d_i = 2.8 mm, d_e = 5.1 mm, L = 700 mm). The temperature of the wall attained 3000°K and that of the gas reached 2500°K; the maximum heat flux was 530 W/cm^2. The ammonia was completely dissociated and the power necessary for dissociation reached 30 per cent of the total power exchanged. Inlet pressure varied between 6 and 16 bars and the maximum pressure drop in the tube reached 15 bars. Two regimes of dissociation, catalytic and homogeneous, were discussed and the variation of dissociation along the length of the tube was studied. The measured heat transfer coefficients may be about 10 times those calculated with classical formulae. A correlation of the experimental results using enthalpy as a driving force for heat transmission is presented. Pressure drops may be calculated by the means of a classical friction factor. Author (ESRO)

N69-40275# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
APPLICATION OF THE BLUNT TRAILING EDGE BLADE CONCEPT TO LOW HUB TIP RATIO TRANSONIC-SUPERSONIC COMPRESSORS Final Report, 1 Apr. 1968 - 31 Mar. 1969
J. Chauvin, F. Bruegelmans, H. Griepentrog, and H. Rottiers Apr. 1969 66 p refs
(Contract F61052-67-C-0018)
(AD-691091; VKI-IN-28; ARL-69-0083) Avail: CFSTI CSCL 13/7

The report covers first cascade calculations and testing on blunt trailing edge blade in the subsonic range. A relaxation method, suitable for the calculation of the flow in blunt trailing edge blade is first described. A semi-empirical method of calculation for the flow in the blade passage in the compressible range, including local supersonic region terminated by normal shock and taking into account shock-boundary layer interaction, is then described as well as its verification against experiment. A semi-empirical correlation of secondary losses against blade camber and aspect ratio is then described, which appears to be of rather general application. The report then describes the design methods utilized and the resulting design for the stator blading adapted to the Mach 2, 0.5 hub-tip ratio rotor designed previously. It covers blade shape evaluation including trailing edge evolution in function of radius, wall shaping and loss prediction. A single blade row, using blunt trailing edge blade is obtained. Author (TAB)

N69-40308# General Dynamics/Connair, San Diego, Calif.
A PROCEDURE FOR CALCULATING THE BOUNDARY LAYER ON AIRFOILS IN SHOCK-FREE COMPRESSIBLE FLOW
5 Dec. 1968 28 p refs
(TN-68-AE-12) Avail: CFSTI

A procedure was developed for describing the boundary layer on a two-dimensional airfoil in shock-free, compressible flow and is presented herein. This procedure is based on the methods developed for the incompressible laminar boundary layer and for the incompressible turbulent boundary layer, together with compressibility transformation. Given the surface pressure distribution, free-stream Mach number, and free-stream Reynolds number, the usual boundary layer parameters together with the turbulent separation point may be determined. The procedure is described together with summaries of the applicable theoretical approaches. Comparisons are made of the procedure with flight test and wind tunnel data for subsonic and transonic speeds. The procedure was programmed in Fortran and is in production status on the Convair CDC 6400 digital computer. Author

N69-40323*# Massachusetts Inst. of Tech., Cambridge.
A STUDY OF FLUID DYNAMICS OF GASEOUS NUCLEAR ROCKETS Quarterly Progress Report, 1 Jul. - 30 Sep. 1969

1 Oct. 1969 19 p refs
(Contract NSR-22-009-288)
(NASA-CR-106310; QPR-6) Avail: CFSTI CSCL 20D

An attempt was made to find out to what extent empirically derived correction terms to laminar theories can be used successfully to predict turbulent results, and to look for direct correlations of the characteristic flow parameters in terms of the independent flow variables of the system. A computer program was written to find the optimum grouping of independent flow parameters which would fit the dependent parameters to a given curve. Author

N69-40330*# Techtran Corp., Glen Burnie, Md.
EXPERIMENTAL INVESTIGATION ON THE ORIGIN OF TURBULENT TUBULAR FLOW [EXPERIMENTELLE UNTERSUCHUNGEN UEBER DIE ENTSTEHUNG DER TURBULENTEN ROHRSTROEMUNG]
A. Naumann. Washington NASA Oct. 1969 27 p refs Transl. into ENGLISH from Z. Techn. Mech. und Thermodyn. (Ger.), v. 2, no. 3, Mar. 1931 p 85 - 98
(Contract NASw-1695)
(NASA-TT-F-12615) Avail: CFSTI CSCL 20D

Tubular flow as a function of Reynold's number is investigated. Visual, photographic and kinematographic dye observations were made in a glass tank and a glass tube. Two critical numbers were observed: the lower represents the beginning of the periodic vortex street, the higher the onset of turbulence. Tubular flow and that around an obstacle are related by undisturbed laminar flow, vortex street region, and turbulence. The inlet vortex was quantified as a function of the Reynold's number from the vortex separation and contraction. Turbulence onset is analyzed. Author

N69-40352# National Physical Lab., Teddington (England). Aerodynamics Div.
CALCULATION OF BOUNDARY-LAYER DEVELOPMENT USING THE TURBULENT ENERGY EQUATION. PART 9: SUMMARY
P. Bradshaw. 30 Jan. 1969 15 p refs
(NPL-AERO-1287; ARC-30909) Avail: CFSTI

Since the empirical relations between turbulence quantities used in this calculation method are, as closely as the data will show, independent of mean flow conditions, the method can be extended to a wide variety of main mean flow conditions, often without the need for extra data. For example, programs have been written for compressible heat transfer and for special cases of unsteady or three-dimensional flow. Further numerical work is needed to combine or generalize these programs. Author (ESRO)

N69-40395# National Aeronautical Lab., Bangalore (India).
NON-EQUILIBRIUM TRANSONIC FLOW PAST SLENDER BODIES
K. N. V. Murthy and N. R. Subramanian. Jul. 1968 19 p refs
(NAL-TN-12) Avail: CFSTI

The flow past a slender airfoil placed in a transonic stream which is out of equilibrium is considered. The third order equation representing the disturbance velocity potential in a nonequilibrium flow was considered and corrected to account for the inclusion of transonic flow range . The resulting non linear third order equation was linearized (by an assumption that holds good in transonic region) and solved using Green's function technique and a Fourier transformation. The source strength function has significant properties of dependence on both airfoil slope as well as curvature. A non linear correction of the linear theory was obtained to take into consideration the characteristics of the transonic flow region. The disturbance velocity was found to drop out rapidly, when drawn as a function of the spatial coordinate, from a quantity determined by frozen Mach number to one determined by equilibrium Mach number. As an example, the simple, case of a circular arc airfoil was considered. The whole theory is valid when the relaxation length parameter is not equal to zero and infinity. Author

N69-40415# Lockheed Missiles and Space Co., Palo Alto, Calif.
APPLICATION OF MULTIPLE BEAM INTERFEROMETRY TO STUDY LOW DENSITY SUPERSONIC GAS FLOWS, CHAPTER 7
I. V. Skokov. 1969 16 p refs Transl. into ENGLISH from the book "Mnogoluchevye Interferometry" Moscow, Mashinostro., 1969 p 152 - 170
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Interference investigations of low density gas dynamics processes are described. Existing as well as new methods and devices in this area are discussed in terms of their sensitivity measurements. Results obtained from multiple beam interference methods show enormous possibilities for multiple beam interferometer utilization in aerodynamic experiments. Experimental data obtained from recording and observing interference patterns are in good agreement with theoretical results and other measurements. J.M.C.

N69-40435# Sandia Corp., Albuquerque, N.Mex. Technical Translation Service.
DIFFERENCE METHOD FOR INTEGRATING THE BOUNDARY-LAYER EQUATIONS IN THE CASE OF COMPRESSIBLE FLUID FLOWS UNDER CONDITIONS OF EXTERNAL AND INTERNAL PROBLEMS. IN BOOK: CONVECTIVE HEAT TRANSFER [RASNOSTNYI METOD INTEGRIROVANIA URAVNENII POGRANICHNOVO SLOYA PRI TECHENII SZHIMAEMOI ZHIDKOSTI V USLOVIYAKH VNESHNEY I VNUTRENNEY ZADACH]
N. I. Nikitenko. 10 Jun. 1969 14 p refs Transl. into ENGLISH from the book "Konvektivnyi Teploobmen" Kiev, Izd. AN Ukr. SSR, 1968 p 147 - 159
(SC-T-69-1025) Avail: CFSTI

A system of equations for a boundary layer for flow of a compressible liquid along a heated penetrated surface is developed. A specific difference method for solving the equations is developed which shows that in the immediate vicinity of the input cross section of the channel, a sharp change of the profile of the velocities and of the friction stress on the walls occur. Thereafter, there is a gradual stabilization of flow. NSA

N69-40483# National Physical Lab., Teddington (England). Aerodynamics Div.
CALCULATION OF BOUNDARY-LAYER DEVELOPMENT USING THE TURBULENT ENERGY EQUATION. PART 7: THREE-DIMENSIONAL FLOW
P. Bradshaw. 30 Jan. 1969 52 p refs
(NPL-AERO-1286; ARC-30910; FM-4018; FM-170) Copyright. Avail: CFSTI

The required equation for the rate of change, along a mean streamline, of shear stress direction, is obtained by using (in vector form) the same assumption about the correlation between fluctuating pressure and fluctuating rate of strain that is implied by the model equation for shear stress magnitude in two dimensions. Agreement with experiment on infinite yawed bodies seems to be within the experimental error (which is sometimes large). Author (ESRO)

N69-40484# National Physical Lab., Teddington (England). Aerodynamics Div.
THE EFFECTS OF THE PRESENCE OF STATIC HOLES ON THE MEASUREMENT OF STATIC PRESSURES ON MODELS AT SUPERSONIC SPEEDS
J. W. Peto and P. G. Pugh. Mar. 1969 19 p refs
(NPL-AERO-1292; ARC-31023; Perf-2798) Copyright. Avail: CFSTI

The effects of static hole size on the measurement of surface pressures on cones at M = 3.08 have been measured. These data were correlated in the form of a multiple regression equation which demonstrates the influence of the significant independent variables.

Using this equation satisfactory predictions are made of the results of other experiments. The effect of boundary-layer state is illustrated. Author (ESRO)

N69-40501 California Inst. of Tech., Pasadena.
FORMATION OF JETS BY IMPULSIVE ACCELERATION OF A CURVED FREE SURFACE
William Paul Gruber (Ph.D. Thesis) 1968 133 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-507

The sudden axial acceleration of a column of liquid bounded at one end by a concave free surface has been found, experimentally, to produce a jet which issues from the free surface with a speed several times that imparted to the column. Theoretical approximations to such flows, valid for small times, are formulated subject to the assumption that the fluid is inviscid and incompressible. In a special two-dimensional case, it is found that, for vanishingly small time, the velocity at the point on the free surface from which the jet emanates is $\pi/2$ times the velocity imparted to the column. The solutions to several problems in two and three dimensions assuming that the initial curvature of the free surface is small, lead to values for this ratio dependent upon the curvature--the initial velocity in the case of axial symmetry exceeding that of the analogous two-dimensional problem by approximately 25%. Experiments conducted upon the phenomenon give values systematically in excess of those predicted by the theory. Dissert. Abstr.

N69-40512# National Physical Lab., Teddington (England). Aerodynamics Div.
A NEW METHOD OF AFTERGLOW VISUALISATION FOR LOW-DENSITY HIGH MACH NUMBER FLOWS
S. C. Metcalf, D. A. J. Walliker (Decca Radar Ltd., Hersham) and C. J. Berry Mar. 1969 10 p refs
(NPL-AERO-1291; ARC-31022; Hyp-740) Copyright. Avail: CFSTI

The development of a simple apparatus for producing afterglow visualisation in wind tunnels at densities considerably below the limit of conventional optical techniques is described. An advantage of this technique is that the excitation is applied at the exit plane of the nozzle. Good results have been obtained in nitrogen, argon and helium and at Mach numbers of 6 and 10. Author (ESRO)

N69-40525 Maryland Univ., College Park.
AN EXPERIMENTAL INVESTIGATION OF THE DRAG OF PARTICLES ACCELERATING WITHIN PARTICULATE CLOUDS AT TRANSONIC SLIP FLOW CONDITIONS BY A LIGHT EXTINCTION TECHNIQUE
Frank Timothy Buckley, Jr. (Ph.D. Thesis) 1968 139 p refs
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-2504

An experimental technique, based on the extinction of light by a cloud of solid particles, has been developed for the measurement of the drag coefficient of particles within clouds accelerating behind a shock front in a shock tube. The order of the derivative that must be evaluated from the experimental data to determine the drag coefficient is one as compared to an order of two needed to reduce photographically obtained results. The technique has been used to measure the drag coefficients of clouds of spherical glass particles having diameters between 74 and 89 microns at average spacings of approximately 16 particle diameters. Data have been obtained in the transonic slip flow regime at Mach numbers between .65 and .80 over a Reynolds number range of from 200 to 1600. The measured drag coefficients are generally higher than a prediction of the steady flow drag coefficient for a single sphere at the same conditions. Dissert. Abstr.

N69-40526 Purdue Univ., Lafayette, Ind.
SHOCK INDUCED UNSTEADY FLOW OF A COMPRESSIBLE REAL GAS OVER A FLAT PLATE
Michael Iserhien Osarugiuwa Ero (Ph.D. Thesis) 1968 197 p refs
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-2913

The flow associated with a shock wavefront moving over a finite flat plate in a gas medium previously at rest has been investigated for a wide range of intensity of the moving shock wave. Two useful mathematical formulations of the flow are examined; the first mathematical model leading to quasi-steady formulation is shown to be valid only in a limited neighborhood of the shock wavefront. The second mathematical formulation leading to generally unsteady governing equations is shown to represent a more realistic description of the flow. The reduction of governing equations is achieved with the aid of an approximate method of weighted residuals. In the solution of either the quasi-steady system of equations or of the complete unsteady system of equations, the medium is assumed to behave first as a perfect gas, and then as nitrogen whose real gas properties are available in tabular form. Dissert. Abstr.

N69-40537# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
NONLINEAR CAPILLARY-GRAVITY WAVES
Raymond B. Wilson and Frederic Bisshopp Nov. 1968 46 p refs
(Contract Nonr-562(42)/8)
(AD-691778; TR-8) Avail: CFSTI CSCL 20/4

In a previous paper we discussed a method for obtaining approximations to the solutions of certain partial differential equations which can be derived from a stationary principle. In this paper we apply this method to a relatively complicated problem--that of nonlinear capillary-gravity waves on a liquid of finite depth. We first consider the problem of linear gravity waves on water of infinite depth, to illustrate both the method and the kind of results we wish to obtain. Author (TAB)

N69-40543# National Bureau of Standards, Washington, D.C.
ON SPHERES AND DOUBLETS IN STRATIFIED FLOWS
Karl Lofquist 24 Dec. 1968 25 p refs
(AD-691414; NBS-9987) Avail: CFSTI CSCL 20/4

A theory is developed for the lee waves behind a sphere moving with constant horizontal velocity through an infinite liquid stably stratified. The analysis treats the difference in the vertical displacement from that known to exist in the non-stratified case. Simplifications in the governing differential equations lead to a class of approximate solutions each of which is defined by a particular form of a function. Author (TAB)

N69-40568# Queen Mary Coll., London (England).
THE STRUCTURE AND BEHAVIOUR OF LAMINAR SEPARATION BUBBLES
M. Gaster (Natl. Phys. Lab., Teddington) Aeron. Res. Council 1969 33 p refs Supersedes NPL-AERO-1181-Rev; ARC-28226
(ARC-R/M-3595; NPL-AERO-1181-Rev; ARC-28226) Copyright. Avail: CFSTI; HMSO: 15s

A study has been made of laminar separation bubbles formed over a wide range of Reynolds numbers and in a variety of pressure distributions. The structure of the bubble depended on the value of the Reynolds number of the separating boundary layer and a parameter based on the pressure rise over the region occupied by the bubble. Conditions for the bursting of 'short' bubbles were determined by a unique relationship between these two parameters. Hot-wire measurements of both mean and fluctuating velocity in the separated region, together with oscilloscope records of the fluctuations, explain some of the flow mechanisms involved. Author (ESRO)

N69-40575# National Physical Lab., Teddington (England). Aerodynamics Div.
CALCULATION OF BOUNDARY-LAYER DEVELOPMENT

USING THE TURBULENT ENERGY EQUATION. PART 6: UNSTEADY FLOW

P. Bradshaw 4 Feb. 1969 15 p refs
(NPL-AERO-1288; ARC-30912) Copyright. Avail: CFSTI

The basic calculation method can be extended to unsteady flow if the variation with time is slow enough for the sublayer to remain quasi-steady and if the shear stress remains positive. Sample calculations for the purely time-dependent flow over an infinite plate, with acceleration of the plate or the free stream, show some interesting difference from spatially-varying flows. Author (ESRO)

N69-40576# National Physical Lab., Teddington (England). Aerodynamics Div.

A PULSED WIRE TECHNIQUE FOR VELOCITY MEASUREMENTS IN HIGHLY TURBULENT FLOWS

L. J. S. Bradbury Jan. 1969 18 p refs
(NPL-AERO-1284; ARC-30851) Copyright Avail: CFSTI

A velocity measuring technique essentially free from non-linear effects and with a well defined response to variations in flow direction is described. The technique is based on that described by Bauer (1965) in which a 'tracer' of heated air is produced by pulsing a fine wire of the sort used in hot wire anemometry with a short duration pulse of electric current. The time taken for this 'tracer' to be convected to another wire operated as a resistance thermometer is measured. Although the technique described in this note is in a very simple form, it is potentially quite powerful and, as an illustration, some measurements of both mean velocity and turbulent intensities in the highly turbulent reverse flow region behind some bluff bodies are described and the results compared with linearized hot wire measurements. Author (ESRO)

N69-40604# Cornell Aeronautical Lab., Inc., Buffalo, N.Y. Hypersonic Facilities Dept.

MEASUREMENTS OF INCIDENT-SHOCK TEST TIME AND REFLECTED SHOCK PRESSURE AT FULLY TURBULENT BOUNDARY-LAYER TEST CONDITIONS

Robert G. Fuehrer Sep. 1969 39 p refs
(CAL-AN-2514-Y-1) Avail: CFSTI

An experimental study has been made of incident-shock test time and end-wall, reflected-shock pressure at test conditions characteristic of high-pressure, high-enthalpy shock tunnels operating in the tailored-interface mode. The driven gas in these experiments was either air or nitrogen and the driver gas was heated hydrogen. The incident-shock Mach number varied from 7.5 to 10.6, and the initial driven-tube pressure varied from 10 to 150 cm Hg. Measurements of the radiation intensity behind the incident shock and Flagg's interpretation of the end-wall pressure dip were used to infer the arrival of the interface region at three different axial stations in the driven tube. Incident-shock test time, for both air and nitrogen, was found to be considerably less than Mirels' turbulent boundary-layer test-time theory predicts at the test conditions commonly used in high-pressure shock-tunnel work. Mirels' theory appears to underestimate the mass flow in the boundary layer, particularly at high Reynolds number test conditions. Suitable modifications of this theory are suggested. Author

N69-40606# Avco-Everett Research Lab., Everett, Mass.

A CLASSICAL THEORY OF ROTATIONAL RELAXATION IN DIATOMIC GASES

C. A. Brau and R. M. Jonkman Aug. 1969 40 p refs
(Rept-338) Avail: CFSTI

In his theory, Parker assumes that the rotational relaxation of diatomic gases may be described by a single relaxation time which is calculated for the special case of initially nonrotating molecules. In the present theory the evolution of the rotational distribution function is described by a diffusion-equation approximation to the master equation. This equation is linearized and solved for the case of acoustic waves. The results indicate that the absorption and dispersion of acoustic waves cannot be described by a single relaxation time. However, the behavior at very low and very high frequencies can be described in terms of apparent relaxation times which differ by approximately fifty percent. The temperature dependence of the apparent relaxation times is similar to that predicted by Parker, but the magnitudes are larger by approximately a factor of two. Author

N69-40626# Akademiya Nauk URSR, Kiev.

INVESTIGATIONS OF UNIFORM AND SUSPENSION-CARRYING TURBULENT FLOWS

1967 119 p refs In RUSSIAN
Avail: CFSTI

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18. EXPERIMENTAL INVESTIGATIONS OF HYDRAULIC

TRANSPORT OF COARSE-GRAINED FRACTIONATED MATERIALS V. M. Karasik and Yu. N. Krivenko p 117–123 refs (See N69-40644 24-12)

N69-40627# Akademiya Nauk URSR, Kiev.
DEVELOPMENT OF TURBULENT FLOW STUDIES AT THE INSTITUTE OF HYDROMECHANICS OF THE UKRAINIAN SSR ACADEMY OF SCIENCES
In its Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 7–8 In RUSSIAN (See N69-40626 24-12)
Avail: CFSTI

The different kinds of turbulent flows studied by Soviet scientists are surveyed. The contributions of individual scientists and institutes to the investigation of turbulent flow are discussed. Transl. by R.B.

N69-40628# Akademiya Nauk URSR, Kiev.
SCALE OF DISSIPATION IN A SHEAR FLOW
Ye. V. Yeremenko *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 9–16 refs In RUSSIAN (See N69-40626 24-12)
Avail: CFSTI

Atmospheric turbulence is evaluated at a minimum vortex scale of $\lambda_0 \approx 0.1$ to 1.0 cm, knowledge of which is essential in turbulent flow investigations. Using semiempirical theory, functions can be derived to calculate minimum vortex and dissipation scales in uniform transverse shear flows. These scales decrease in proportion to the approach of the flow to boundary surfaces and to the increase in Reynolds number, and they facilitate accurate qualitative analyses. Transl. by R.B.

N69-40629# Akademiya Nauk URSR, Kiev.
GENERALIZED FUNCTIONS FOR CALCULATING STABILIZED TURBULENT FLOW BY THE TWO-PHASE METHOD
I. K. Nikitin *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 17–25 refs In RUSSIAN (See N69-40626 24-12)
Avail: CFSTI

Stabilized flow is assumed to be the steady motion of a fluid which does not vary along a horizontal axis aligned in the direction of flow. Flow patterns with Reynolds numbers much higher than critical Reynolds number, characterizing transition from laminar to turbulent flow, are considered. A semiempirical theory of stabilized turbulent flow is developed to generalize solutions for fluid motion near smooth and rough boundaries. The theory provides single functions for calculating coefficients of resistance and velocity distribution in pipes and channels with walls of various texture. Transl. by R.B.

N69-40630# Akademiya Nauk URSR, Kiev.
SOME UNIQUE FEATURES OF LIQUID FLOW NEAR A SMOOTH WALL
I. K. Nikitin, V. S. Nishchuk, and A. G. Marchenko *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 26–34 refs In RUSSIAN (See N69-40626 24-12)
Avail: CFSTI

The existence of a boundary sublayer in turbulent flows near rough surfaces has been established, from which a general solution for problems of turbulent flows caused by both smooth and rough walls can be constructed. The solution is based on a new two-phase flow scheme according to which the flow is divided into a turbulent flow nucleus and the boundary sublayer. The validity of this delineation for all flow patterns with developed turbulence is supported by experiments in rectangular and square channels and pipes, and by comparison with previous measurements. The sublayer is characterized by a turbulent flow, which permits unifying different types of flow near smooth and rough walls, and which may be the basis for developing a turbulent liquid motion theory unique for these types of surfaces. Functions are derived to calculate the kinematic characteristics of such flows. Transl. by R.B.

N69-40631# Akademiya Nauk URSR, Kiev.
THE EFFECT OF FLOW IRREGULARITY ON EROSION CAPACITY
A. N. Shabrin *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 35–41 refs In RUSSIAN (See N69-40626 24-12)
Avail: CFSTI

The interaction of an accelerated unsteady flow with an eroded channel is discussed and the characteristic features of this interaction are explained from experimental data and by analysis of functions which characterize the dynamic equilibrium of solid particles during turbulent flow around them. Experiments show that a decrease or increase in the turbulence level causes a corresponding decrease or increase in the erosion capacity of the flow. Erosion rates during accelerated motion may be approximated by functions obtained for steady flow conditions. Transl. by R.B.

N69-40632# Akademiya Nauk URSR, Kiev.
ACTUAL VELOCITIES AND EROSION CAPACITY OF NON-UNIFORM UNSEPARATED FLOWS
E. V. Zalutskiy *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 42–48 refs In RUSSIAN (See N69-40626 24-12)
Avail: CFSTI

Erosion of channels depends on the type of underlying material and on the parameters characterizing the flow. Investigations of the erosion capacity of flows show that the maximum velocity acting on the bottom of the channel may be regarded as actual velocity comprising the sum of the average velocity in time or statistical aggregate at a flow point and its root-mean-square pulsating longitudinal component. The erosion capacity of nonuniform unseparated flows can be approximated by existing functions obtained for uniform flow conditions. Transl. by R.B.

N69-40633# Akademiya Nauk URSR, Kiev.
PRODUCTION OF TURBULENCE AT THE INTERFACE OF AN OPEN FLOW RESTRICTED IN DEPTH
N. G. Poznyaya *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 49–53 refs In RUSSIAN (See N69-40626 24-12)
Avail: CFSTI

An equilibrium equation for average motion energy is constructed for a steady, three-dimensional, open mean flow. Analysis of the equation shows that, unlike uniform flow, where transition of mean flow energy to pulsating flow is irreversible, both the transition of mean flow to pulsating flow energy and transition of pulsating flow to mean flow energy is observed when the liquid-solid interface is a source of increased turbulence. Transl. by R.B.

N69-40634# Akademiya Nauk URSR, Kiev.
DAMPING OF INCREASED TURBULENCE IN AN OPEN FLOW BEHIND A WATER SPILLWAY
I. Ye. Lipay and V. F. Pustovoyt *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 54–59 refs In RUSSIAN (See N69-40626 24-12)
Avail: CFSTI

Detailed study of flow structure on the apron behind a water spillway has established the nature of the damping of increased turbulence in an open channel flow. Formation of increased velocity fluctuations in an anisotropic flow is less intense than that in isotropic turbulence. Transl. by R.B.

N69-40635# Akademiya Nauk URSR, Kiev.
INVESTIGATIONS OF THE VELOCITY STRUCTURE OF UNDISTURBED FLOWS BEHIND EXPANDING FUNNELS

WITH A CASCADE

V. I. Gayduchenko *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 60-65 refs In RUSSIAN (See N69-40626 24-12)

Avail: CFSTI

The erosion capacity of a flow depends on the magnitude of maximum instantaneous velocity and on the fluctuation of velocity in the bottom zone of the flow. The longitudinal components of these velocities are greater in the bottom zone behind an expanding funnel than those components where no funnel exists, and they decrease with distance downstream. Based on studies of different variants of spillway aprons, and in order to prevent spillway flows from exceeding permissable limits, a model is proposed for an expanding damping funnel with a cascade to convert turbulent flow to steady flow. Transl. by R.B.

N69-40636# Akademiya Nauk URSR, Kiev.

APPLYING THE METHOD OF BOUNDARY PERTURBATION IN VISCOUS LIQUID THEORY

Ye. V. Bruyatskiy *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 66-74 refs In RUSSIAN (See N69-40626 24-12)

Avail: CFSTI

An approximation method is proposed for solving the problem of two-dimensional plane steady flow of an incompressible liquid around a cylindrical body of arbitrary shape for the case when Navier-Stokes equations of motion, linearized by Oseen approximation, are the initial equations. The method is based on that known in elasticity theory as boundary perturbation, from which the method of conformal transformation is derived. Transl. by R.B.

N69-40637# Akademiya Nauk URSR, Kiev.

TURBULENCE RESISTANCE DURING UNSTEADY MOTION OF A BLUFF BODY

B. M. Yegidis *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 75-79 refs In RUSSIAN (See N69-40626 24-12)

Avail: CFSTI

The natural frequency of free oscillations of an elastically fixed sphere (the receiving element of a spherical sensor) in an undisturbed liquid and in a flow was measured to compare the values of added masses during separated and unseparated flow around it. In both cases, no significant differences were noted in the values of natural oscillation frequencies, indicating that the added masses are equal. The resistance of the spherical sensor receiving element to the accelerated liquid flow was determined from study of errors in the sensor. A method was developed for analytical determination of the variation in turbulence resistance in time with the help of an empirical or semiempirical function for deviation of turbulence resistance from parameters which determine the inertia properties of the body-flow system. Transl. by R.B.

N69-40638# Kiev Polytechnic (USSR).

SOME THEORETICAL CONSIDERATIONS ABOUT THE STRUCTURE OF COMPUTATION FORMULAS FOR SPECIFIC CRITICAL VELOCITIES DURING MOTION OF SUSPENSION-CARRYING FLOWS IN A HORIZONTAL CYLINDRICAL PIPE

I. A. Pishchenko *In* Akad. Nauk URSR Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 80-85 refs In RUSSIAN (See N69-40626 24-12)

Avail: CFSTI

Since a suspension-carrying flow consists of liquid and solid components, and since motion of the solid particles takes place only during turbulent motion of the carrying liquid, the computation formulas derived for critical velocities are related to two-dimensional flow. Quantitative analysis of the different forces interacting in a suspension-carrying flow being impossible, it is assumed that a particle is spherical or similar in shape, that its separation occurs under conditions of hydrodynamic equilibrium, and that it is located at a mean level in the flow. On this basis, a functional expression for critical flow velocity can be constructed. Transl. by R.B.

N69-40639# Akademiya Nauk URSR, Kiev.

CALCULATING THE CRITICAL VELOCITY OF PARTICLE-LADEN AIR

N. A. Silin and V. N. Kondakov *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 86-87 In RUSSIAN (See N69-40626 24-12)

Avail: CFSTI

Investigations of the kinematic structure of particle-laden air in pipelines indicate a definite identity of processes governing suspension and movement of solid particles by air and water flows, and, consequently, of laws describing these processes. This identity permits functions for calculating hydraulic transport processes to be applied, with appropriate corrections, to pneumatic transport of particle-air mixtures. Transl. by R.B.

N69-40640# Akademiya Nauk URSR, Kiev.

INVESTIGATION OF THE CONSISTENCY DISTRIBUTION OF A TWO-COMPONENT FLOW

V. F. Ocheretko *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 88-95 In RUSSIAN (See N69-40626 24-12)

Avail: CFSTI

A method is outlined for calculating the characteristics of a consistency field from cinematographic data. This method permits obtaining such characteristics as average and fluctuating consistency values, and also moments of correlation of longitudinal and vertical velocity fluctuations for both solid particles and liquids. Transl. by R.B.

N69-40641# Akademiya Nauk URSR, Kiev.

THE VELOCITY STRUCTURE OF A TWO-COMPONENT FLOW

V. F. Ocheretko *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 96-99 refs In RUSSIAN (See N69-40626 24-12)

Avail: CFSTI

Nonuniform distribution of consistency causes distribution of average longitudinal velocities along the flow path to become asymmetrical: they are greater in the upper part of the flow than in the lower part, and the dynamic flow axis is shifted upward with respect to the geometrical axis of the pipe. Experiments show that adding solid particles to a homogeneous liquid causes an increase in pulsating velocities and correlation moments, as a result of which flow turbulence is increased. Transl. by R.B.

N69-40642# Akademiya Nauk URSR, Kiev.

CALCULATING THE SINTERING PROCESS OF DISPERSED MATERIALS IN A VERTICAL TWO-PHASE FLOW

G. L. Babukha and A. A. Shrayber *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 100-106 refs In RUSSIAN (See N69-40626 24-12)

Avail: CFSTI

The process of thermal granulation of a semidispersed material in a vertical flow is considered under conditions that some granules move downward to encounter a gas, particles of the initial raw material, and finer grains, the positive direction being considered upward. The effect of the channel walls and turbulent pulsations of the gas flow are disregarded. A set of integrodifferential equations based on previous investigations is then constructed to describe the sintering process. Transl. by R.B.

N69-40643# Akademiya Nauk URSR, Kiev.

THE EFFECT OF DENSITY AND HETEROGENEITY OF TRANSPORTED RESIDUES ON HYDRAULIC RESISTANCES AND CRITICAL VELOCITIES IN PIPES

S. G. Kobernik and V. I. Voytenko *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 107–116 refs In RUSSIAN (See N69-40626 24-12)
Avail: CFSTI

Laboratory experiments on the hydraulic transport of residues and sands were carried out to discover and evaluate the effect of density, average grain size, and heterogeneity on pressure losses and critical velocities. The experiments permitted formulation of equations to calculate transport of ore-enriching residues. Transl. by R.B.

N69-40644# Akademiya Nauk URSR, Kiev.
EXPERIMENTAL INVESTIGATIONS OF HYDRAULIC TRANSPORT OF COARSE-GRAINED FRACTIONATED MATERIALS
V. M. Karasik and Yu. N. Krivenko *In its* Invest. of Uniform and Suspension-Carrying Turbulent Flows 1967 p 117–123 refs In RUSSIAN (See N69-40626 24-12)
Avail: CFSTI

The investigations were conducted in a circular hydraulic conveyer installation 100 mm in diameter with an electrically driven 4.5 hp pump, which permitted control of the water-gravel mixture rate of motion over a wide range. Volumetric consistency of the mixture varied from 3% to 30%. The density distribution of the mixture depends to a significant degree on its mean flow velocity, and distribution is not uniform along the horizontal chords of the pipe. The distribution of mean longitudinal velocities in the flow is predetermined by the density distribution of the mixture in the lower part of the pipe, which is governed by friction forces between the particles themselves as well as by friction of the particles against the walls of the pipe. The problems of finding the interaction boundary of the denser bottom layer and the pipe wall, and the effect of two-phase flow parameters on this boundary are left unresolved. Transl. by R.B.

N69-40647# Naval Ordnance Lab., White Oak, Md.
AN EXPLORATORY THEORETICAL INVESTIGATION OF THE EFFECT OF LONGITUDINAL SURFACE CURVATURE ON THE TURBULENT BOUNDARY LAYER Final Report
Neal Tetervin Feb. 1969 69 p refs
(AD-691419; NOLTR-69-22) Avail: CFSTI CSCL 20/4

The equations of motion and total enthalpy are derived for a compressible turbulent boundary layer on an axisymmetric or two-dimensional surface with non-negligible longitudinal curvature. From these equations are derived the integral-momentum, kinetic-energy, and total-enthalpy equations for non-negligible longitudinal curvature. Calculations indicate that if concave curvature increases the skin friction sufficiently separation is delayed although the boundary layer is thickened. Also, an increase in curvature in the direction in which the surface pressure rises acts to hasten separation for concave curvature and delay it for convex curvature. Author (TAB)

N69-40715# Cambridge Univ. (England). Dept. of Engineering.
BOUNDARY LAYER PROBLEMS IN AXIAL TURBOMACHINES
J. H. Horlock [1969] 66 p refs
(CUED/A-Turbo/TR-1) Avail: CFSTI

Attempts to calculate the two-dimensional profile boundary layers (both laminar and turbulent) in cascades are described and the results compared with experiment. In extending such calculations to the flow in a turbomachine, account is taken of higher turbulence levels, of the blockage due to the development of the wall boundary layers and the consequent contraction of the mainstream flow, and of the effects of centrifugal and Coriolis forces associated with swirl and rotation respectively. Two solutions to the annulus wall boundary layer problem are discussed. (1) Empirical data for boundary layer growth across a blade row enable an accurate assessment of the streamwise velocity profile. Inviscid secondary flow analyses are then used to give the angle variations in the spanwise direction existing inside and outside the boundary layer, although such estimates do not always give the required accuracy. (2) The boundary equations are written for an axisymmetric flow with distributed body forces simulating the tangential pressure gradients caused by the blades. The assumption of streamwise and transverse velocity profiles enables a solution of the equations obtained within the boundary layer region. Author

N69-40794# Princeton Univ., N.J.
THERMAL RECOVERY FACTORS IN SUPERSONIC FLOWS OF GAS MIXTURES
George Maise and John B. Fenn Lafayette, Ind. Purdue Univ. Jul. 1969 41 p refs Prepared in cooperation with Purdue Univ.
(Contract N00014-67-A-0226; Proj. SQUID)
(AD-691447; SQUID-TR-PR-117-PU) Avail: CFSTI CSCL 20/4

Thermal recovery factors were measured at the stagnation point of a hemispheric probe in low density supersonic jets of helium-argon and hydrogen-nitrogen mixtures. A guard heater in the probe made it possible to eliminate conduction losses. Radiation corrections were small. The final values correspond to adiabatic conditions. With jets of mixed gases the experimental recovery factors were as high as 1.6, substantially above the free molecule limit for pure gases. It is suggested that these anomalously high values are due to the species separation which occurs during the stagnation process and which results in concentrations of heavy species in the stagnation zone higher than in the free stream. The results are correlated in terms of the degree of rarefaction and the composition of the source gas. Author (TAB)

N69-40824*# National Aeronautics and Space Administration, Washington, D.C.
SHOCK WAVES IN REAL GASES
T. V. Bazhenova et al. Oct. 1969 187 p refs Transl. into ENGLISH of the book "Udarnyye Volny v Realnykh Gazakh" Moscow, Nauka Press, 1968 p 15–195
(NASA-TT-F-585) Avail: CFSTI CSCL 20D

The propagation of strong shock waves are considered in terms of the real properties of the gas media, since the temperature increase behind the shock wave produces excitation and ionization. Visualization and photographic techniques for studying shock wave propagation in shock tubes are described. Gas dynamic flow variables, and the reflection of shock waves in various gases are discussed. Results of the study are tabulated. F.O.S.

N69-40826# Princeton Univ., N.J. Gas Dynamics Lab.
NUMERICAL SOLUTIONS OF THE TIME-DEPENDENT INCOMPRESSIBLE VISCOUS FLOW OVER A DISK OR A SPHERE
Yermiyahu Rimon Wright-Patterson AFB, Ohio ARL Apr. 1969 132 p refs
(Contract F33615-67-C-1065; Grant NSF GP-579)
(AD-691842; ARL-69-0063) Avail: CFSTI CSCL 20/4

The Navier-Stokes equations for incompressible axisymmetric flow over a disk or a sphere are solved by means of finite difference approximation. The Reynolds number range covered is 1-1000. Time-dependent Stream function-Vorticity formulation in cylindrical and spherical polar coordinate systems is adopted. The surface of the disk and the sphere is conveniently represented by coordinate lines. Explicit central Dufort-Frankel differencing in time is employed. Second order accuracy conservative differencing is used for the spatial variables. For the disk case, vorticity and stream function are defined on mesh points, while the velocity components are defined at the midpoints of the mesh cells. The latter leads to difficulties with the implementation of boundary conditions. Therefore, in the sphere case all the dependent variables are defined on mesh points. Separate linearized criterions for diffusion and convective terms were used to guide the selection of an empirical relation between time and space increments of the entire Navier-Stokes equations. It was found that in the initial phase of

the solution, especially at low Reynolds numbers, time steps considerably smaller than those suggested by the stability criterion must be used. The condition to be observed for stable solutions appears to be that the fractional change of the vorticity at any point over a time step is small. Author (TAB)

N69-40833# Brown Univ., Providence, R.I.
THE EFFECTS OF FREE-STREAM TURBULENCE AND OF SOUND UPON HEAT TRANSFER Final Report
Joseph Kestin and Peter D. Richardson Apr. 1969 58 p refs
(Contract F33615-67-C-1754)
(AD-691497; ARL-69-0062) Avail: CFSTI CSCL 20/4

The program of work was directed to the study of the effects of free-stream turbulence and of flow oscillations on the shearing stresses and heat transfer from immersed bodies to fluid streams, and to the study of local effects of intense sound fields on flow and heat transfer. Analytical and experimental investigations of the effects of free-stream turbulence on flow and heat transfer were performed for forward stagnation regions (on both a flat plate and a cylinder), and for a flat plate with a rounded leading edge in zero and favorable pressure gradients. Experiments and analysis for effects of sound on natural convection gave closely corresponding values for local heat transfer rates. A resonant interaction of sound with separated shear layers was investigated experimentally. Author (TAB)

N69-40835# New York Univ., N.Y.
DYNAMICS OF DEFORMATION OF LIQUID DROPS
H. H. Chiu Wright-Patterson AFB, Ohio ARL Apr. 1969 60 p refs
(Contract F33615-68-C-1184)
(AD-691498; NYU-AA-68-45; ARL-69-0065) Avail: CFSTI CSCL 20/4

A time dependent analysis is made of the deformation of an initially spherical drop moving in an unbound fluid at low Reynolds number. It is found that the excitation of a particular mode of deformation, including simple deformation, oscillation, and unstable deformation, depends on the Reynolds number, Weber number, the ratios of the two fluid densities and viscosities. The result of an analysis in the limit of vanishing voscosities shows that the droplet vibrates. The characteristic frequency obtained in the present analysis agrees with that previously obtained by H. Lamb. For large viscosities a limiting analysis indicates that a droplet deforms asymptotically to the equilibrium shape predicted by T. D. Taylor and A. Acrivos. The characteristic time of the deformation for ethyl alcohol droplets of 20 to 80 micrometers in diameter vary approximately from 0.001 sec to 0.005 sec. The effects of increasing temperature and pressure, free stream velocity and the droplet size are examined numerically for the deformation of ethyl alcohol drops. The unstable modes of deformation are likely to be excited at Reynolds number and Weber number both greater than unity. Author (TAB)

N69-40882# Technische Hochschule Munchen (West Germany).
EXCERPT FROM THE DISSOLUTION OF SOLID PHASES IN TURBULENT LIQUIDS IN THE PRESENCE OR ABSENCE OF SECONDARY CHEMICAL REACTIONS [AUSZUG AUS ZUR AUFLOESUNG FESTER PHASEN IN TURBULENT BEWEGTEN FLUESSIGKEITEN BEI AN-UND ABWESENHEIT CHEMISCHER FOLGEREAKTIONEN]
Hans-Friedrich Klunker 1969 26 p refs In GERMAN
Avail: CFSTI

Reaction kinetics during the physical dissolution of solid phases in turbulent flow fields are analyzed in order to determine boundary layer reactions. Differentiation of the reactions along phase boundaries is expressed in the phase equilibria between solid and liquid and the reaction velocity which in turn determines the dynamic equilibrium. Several mathematical dissolution models are formed that use high transport velocities to obtain optimal phase transfer reactions. Experimental results from the dissolution of compressed cylindrical tablets in a water flow of 10 m/s showed that a linear correlation exists between material transfer values and median flow velocities. Transl. by G.G.

N69-40885 Illinois Univ., Urbana.
TOPICS IN FLUID PHASE TRANSITIONS
Jack Bernard Swift (Ph.D. Thesis) 1968 128 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-1465

Dynamic critical point phenomena in fluid systems are studied first by means of models and then with the aid of the scaling laws for critical exponents. Two models whose equilibrium distribution functions reduce to the standard Ising model density matrices and whose time dependences are governed by master equations are introduced. The first model gives spin and heat diffusion and a proof similar to that of Kawasaki that the transport coefficients are finite near the critical point holds. The second model, which gives sound waves and heat and transverse momentum diffusion, admits the possibility of infinite transport coefficients. Dissert. Abstr.

N69-40946*# Rocketdyne, Canoga Park, Calif.
ADVANCED FEED SYSTEM COMPONENT INTERACTION ANALYSIS Quarterly Status Letter, 30 Jun. - 30 Sep. 1969
L. E. Sack 17 Oct. 1969 61 p refs
(Contract NAS7-749)
(NASA-CR-106450; QSL-9229-3) Avail: CFSTI CSCL 20D

A dynamic model of the MM'69 pressure regulator was developed. The development of the equations and their mechanization on the analog computer are presented herein. This model was used to generate transient performance data with high, constant, upstream pressure, and a simplified downstream flow system and accumulator. This data indicates that poppet oscillations are present whenever the spring is operating in the region of large negative slope. A simplified model of the regulator and water expulsion system was also developed. This model and preliminary results obtained with it are presented herein. Dynamic equations of the flow bench system were also developed. The basic equations are presented. Author

N69-40967 Purdue Univ., Lafayette, Ind.
STRUCTURE OF SHOCK WAVES WITH NONEQUILIBRIUM RADIATION AND IONIZATION
Harlan Frederick Nelson (Ph.D. Thesis) 1968 177 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-2966

The physical processes occurring in the precursor and during the approach to equilibrium behind strong shock waves in argon are theoretically investigated. Shock waves propagating at Mach 24 into cold argon at pressures of 0.2, 1.0 and 10.0 cm Hg are considered along with the influence both in the precursor and the relaxation region of different atom-atom rates. The model includes the chemical ionization rates due to atom-atom and electron-atom collisions and photoionization. The gas is regarded as a combination of two gases, one consisting of the electrons and the other the atoms and ions. Temperature differences between the two gases affect not only the approach to equilibrium behind the shock wave, but also the precursor. A two level plus continuum model is used for the argon atom. Dissert. Abstr.

N69-41042# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
INFLUENCE OF CROSS FLOW ON TWO DIMENSIONAL SEPARATION Interim Scientific Report, 1 May 1968 - 30 Apr. 1969
Jean J. Ginoux and Roger LeBlanc May 1969 23 p refs
(Grant AF-EOAR-0026-68)
(AD-691491; CR-69-GI-4-3; ARL-69-0110) Avail: CFSTI CSCL 20/4

The report is a review of some of the problems associated with the design of a rotating axi-symmetric body to study the

effect of cross flow on two dimensional separation. A hollow cylinder flare model with 8 in. diameter was designed to rotate up to 5,000 r.p.m. in the 16 in. x 16 in. test section of the VKI continuous supersonic wind tunnel S-1 at a free stream Mach number of 2.25. Problems related to the static pressure measuring equipment, the optimum model configuration, the model driving mechanism and the model vibrations are discussed. Author (TAB)

N69-41044# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ENERGETICS PARAMETER AND SCALE EFFECT IN CAVITATION EROSION

K. K. Shalnev 22 May 1969 18 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Izv. Mekan. i Mashinostroenie (Russian), no. 5, 1961 p 3-10

(AD-691645; FTD-HT-23-73-69) Avail: CFSTI CSCL 20/4

An energetics parameter of cavitation erosion is introduced for estimating the resistance of materials to erosion. By means of this parameter the power dependence of scale numbers for dimensions and the velocities is explained. It is noted that an erosion of uniform intensity should be observed in small models at a faster rate than in large models. Conditions are established for predicting the volume of erosion from experiments with models. Author (TAB)

N69-41055*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN EXPERIMENTAL INVESTIGATION OF TAYLOR'S HYPOTHESIS FOR ATMOSPHERIC BOUNDARY LAYER FLOW

Rodney L. Duncan (M.S. Thesis - Va. Polytech. Inst.) Jun. 1969 107 p refs

(NASA-TM-X-61902) Avail: CFSTI CSCL 20D

Results of a research project at Wallops Island, Virginia using a full-scale Jupiter missile to evaluate the effects of turbulence and shear flow on the response of launch vehicles are analyzed. Data were obtained concerning the wind environment of the area; the spatial correlation of gust velocities during transport by the mean was of particular interest. Horizontal components of turbulence were determined up to a height of 53 feet using a fast response, drag-sphere anemometer. Seven data samples were recorded during an elapsed time of approximately four hours. The mean wind speeds measured at a height of 65 feet were between 37 and 48.5 fps; meteorological conditions did not change significantly during this time interval. Natural boundary layer characteristics, as well as cross correlation functions were determined experimentally and compared with values obtained from Taylor's hypothesis for atmospheric boundary layer flow. A.C.R.

N69-41074# Lockheed Missiles and Space Co., Palo Alto, Calif.

LAMINAR BOUNDARY LAYER IN A COMPRESSIBLE GAS FOR GIVEN SURFACE TEMPERATURE AND PRESENCE OF SUCTION

L. F. Kozlov [1969] 6 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 5, no. 7, 1969 p 93-98

Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

An approximation method is developed for computing the laminar boundary layer characteristics on a heat insulated surface for high gas velocities and in the presence of gas suction through the permeable body surface. Assuming Prandtl number to be one, a system of laminar boundary layer differential equations taking account of the longitudinal pressure gradient on the outer boundary is constructed. The proposed method has been developed in application to plane flow. With appropriate alteration, the same equations for plane flow can be used for an axisymmetric boundary layer on a body of revolution. R.B.

N69-41172# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON ENERGY TRANSFER BY RADIATION IN SPECTRAL LINES

Iu. D. Shmyglevskii 1969 10 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekh. Fiz. (USSR), no. 3, 1969 p 12-20

Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Radiant energy transfer in moving media is described by a system of integro-differential equations. The integral term in the equations makes computations difficult because of the huge quantity of calculations needed. A quadruple integral in space must be evaluated at each point of this space in a computation of three-dimensional, and even axisymmetric, flows. The case of local thermodynamic equilibrium is examined below. The spectral line displacement in temperature and pressure is assumed. An idealized representation of the frequency dependence of the gas absorption coefficient is proposed. This representation substantially simplifies the radiant heat exchange mechanism, and permits explicity integration of the transfer equation. In the spherical symmetry case, considered as illustration, the simplifications go farther, and result in differential equations without integral terms. If the radiation and absorption pass into a finite number of spectral lines, then the resultant heat influx to the particle because of radiation is found by simple summation of the characteristic line frequencies. The proposed representation of the absorption coefficient in such a form can be the basis for numerical methods. Author

N69-41198 Purdue Univ., Lafayette, Ind.

SOME PROBLEMS OF WAVE PROPAGATION

Shih-Liang Wen (Ph.D. Thesis) 1968 94 p

Avail: Univ. Microfilms: EC $4.80/Microfilm $3.00 Order No. 69-2996

This thesis considers two different problems in wave propagation. Part I consists of a linear constant coefficient partial differential equation with a small parameter, ϵ, appearing in lower order derivative terms. A multiple Fourier integral representation of the solution is evaluated to yield a far field solution for $\epsilon \ll 1$. An application is made to the problem of steady three-dimensional flow of a stratified fluid with uniform density gradient and unbounded extent. Part II consists of a study of effects of viscosity on non-linear long waves. Beginning with the Navier-Stokes equations of motion, the long wave approximation is achieved by an expansion scheme similar to Friedrichs'. Non-linear solutions are obtained by applying the theory of relatively undistorted waves. It is found that shock formation is delayed by the viscous effect. Dissert. Abstr.

N69-41213*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF THE MIXING REGION FOR A TWO-DIMENSIONAL JET INJECTED AT AN ANGLE TO A MOVING STREAM

Willis Braun and Marvin E. Goldstein Washington Nov. 1969 25 p refs

(NASA-TN-D-5531; E-5163) Avail: CFSTI CSCL 20D

An analysis was made of the laminar and turbulent mixing of a two-dimensional jet issuing from an orifice whose two walls are parallel to the free-stream velocity but not necessarily coplanar with each other. The difference of total pressure between the jet and the stream is assumed small compared with the dynamic pressure of the stream. The results of previous inviscid analyses are used to obtain the velocity profiles in the mixing region and the thickness of the region for jets which are separated from the downstream wall and for those which are attached. Results show that, when the orifice walls are coplanar, the attached jet has higher velocities than the separated jet as it turns into the stream; therefore, the attached jet has a thinner mixing region. Author

N69-41273# Ballistic Research Labs., Aberdeen Proving Ground, Md.

TWO-WAVELENGTH LASER INTERFEROMETRY OF HYPERSONIC IONIZED FLOWS

F. H. Oertel and J. H. Spurk. May 1969. 3 p. refs.
(AD-691329; BRL-R-1435) Avail: CFSTI. CSCL 20/4

An experiment to measure the electron concentration in a hypersonic flow is described. The experimental method, two-wavelength interferometry, is based on the fact that the refractivity of the heavy polarizable particles (atoms and ions) is practically independent of wavelength, while the refractivity for free electrons is proportional to the square of the wavelength and negative. A Mach-Zehnder optical interferometer backlighted by a giant pulse ruby laser is used. The flow is a hypersonic high energy flow of argon over a two-inch diameter spherical body. The free stream velocity is 5180 m/s. At a free stream density of 0.024 kg/cu. meters and a free stream pressure of 3640 N/sq meters, the electron number density at the stagnation point is 4 x 10 to the 17th power/cc. Author (TAB)

N69-41307# California Univ., Livermore. Lawrence Radiation Lab.
CALCULATION OF ELASTIC PLASTIC FLOW
Mark L. Wilkins. 24 Jan. 1969. 101 p. refs.
(UCRL-7322-REV-1) Avail: CFSTI

Computer programs based on the artificial viscosity method are presented for solving problems in dynamic plasticity. The programs are formulated in one-space dimension and in two-space dimensions with axial symmetry. The constitutive equations are organized so that loading and unloading paths are automatically treated. Details are presented for calculation of sliding interfaces and of opening and closing of voids. Examples ranging from quasi-static elastic-plastic flow to dynamic problems involving elastic-plastic shocks are given. Author (NSA)

N69-41317 Minnesota Univ., Minneapolis.
DETERMINATION OF THERMAL DIFFUSION FACTORS IN BINARY GAS SYSTEMS
William Gerald Wyatt (Ph.D. Thesis). 1968. 158 p.
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00. Order No. 69-1546

Improvements are made on an experimental method for measuring the thermal diffusion factor in binary gas mixtures. The method is based on a combination of convective and diffusive flow in which the lighter of two gases is introduced at the top of a vertical cylinder and flows slowly downward. The heavier gas flows by the lower end of the cylinder in a perpendicular direction. A temperature gradient is generated by the diffusion-thermo effect and by applying the laws of conservation of energy, mass, and momentum on the flow in the cylinder the thermal diffusion factor is obtained. The concentration is determined by continuously drawing a gas sample through a glass tube to a thermal conductivity cell. Gas temperature is held constant by immersing the entire test section in a constant temperature bath. A computer program is utilized to choose the size of the test section. The program predicts the velocity and temperature profiles in the cylinder for various lengths and diameters and measurements are taken to verify the velocity profiles. Mass flow rates are obtained by calibrated capillary tubes. The results are compared with those obtained by other workers and with theory. Dissert. Abstr.

N69-41344# Lockheed Missiles and Space Co., Palto Alto, Calif.
TEMPERATURE OF AN ADIABATIC FLAT PLATE IN A FLOW WITH FULLY DEVELOPED TURBULENT BOUNDARY LAYER
V. M. Repukhov. [1969] 6 p. refs. Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. RSR, Ser. A, Fiz.-Tekh. Matem. Nauk (Kiev), no. 8, 1969 p. 733 - 738
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The temperature of an adiabatic wall around which a flow with given velocity and temperature profiles in cross-sectional flows is studied for the determination of the efficiency of thermal wall protection by using gas shielding. The assumption is that a gradient flow in the unperturbed domain flows around a flat plate, and becomes adiabatic at the initial section. A fully developed dynamic turbulent boundary layer is observed on it. The solution of the problem under consideration is reduced to the solution of the Spalding equations. In this formulation solutions for two extreme cases are possible: the first holds for large Pradtl numbers, and the other is applicable to Prandtl numbers close to one. Author

N69-41372# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
THE SPREAD OF OIL SLICKS ON A CALM SEA
James A. Fay. Aug. 1969. 15 p. refs. *Its* Fluid Mech. Lab. Publ. No. 69-6
Avail: CFSTI

The spreading of oil on the open seas is studied by determining the rate of spread of a finite quantity of oil on still water. It is shown that as it spreads outwards the moving layer of oil drags a thin layer of water. Based on this model the magnitude of the forces, i.e., surface tension, gravity, inertia, and viscosity, are formulated. The calculated results are compared to the limited number of actual observations of the spread of oil slicks on the open seas. F.O.S.

N69-41373 National Lending Library for Science and Technology, Boston Spa (England).
ON INTEGRAL INVARIANTS IN SYSTEMS OF THE HYDRODYNAMIC TYPE
A. M. Obuhov. 20 Jul. 1969. 15 p. refs. Transl. into ENGLISH from Dokl. Akad. Nauk (Moscow), no. 184, 1969 p. 309 - 312
(NLL-M-7720-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Hydrodynamical systems which include rigid body dynamics and finite-dimensional analogs of an ideal incompressible fluid are examined. Energy integral conditions which alter the dynamical tensor are analyzed in terms of regularity conditions, Euler's equations of motion, and corresponding canonical forms of the equations of motion. Invariant characteristics of hydrodynamic systems are fitted into a natural coordinate system and described by statistical mechanics methods. Quadratic integrals analyzed by Gaussian distributions are discussed. The method of moments was used in statistical hydrodynamical systems having symmetrical tensors, and equations of motion providing chains of equation for the solution of statistical hydrodynamic systems were found. M.H.E.

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N69-40007# Environmental Research Corp., Alexandria, Va.
SEISMIC INTERFERENCE AND RECIPROCITY FOR THE H E ROW CHARGE
P. C. Loux and J. R. Murphy. 31 Dec. 1968. 36 p. refs.
(Contract AT(29-2)-1163)
(PNE-611) Avail: CFSTI

Project Dugout was a chemical explosive row charge cratering experiment in hard rock conducted to extend knowledge of row cratering phenomenology to a hard rock medium. Recorded Dugout strong motion seismograph data explore the questions of seismic interference and reciprocity. The expectation of linear relationships for the seismic motion resulting from energy imparted from each of the row charge elements is challenged. Even so, the linear relationships are tested with Dugout data in the interest of developing techniques for refined predictions of seismic effects from row charges. Neither interference nor the reciprocity phenomena are clearly exhibited in the Dugout data, but these results are shown to be inconclusive due to inappropriate test data. Author (NSA)

N69-40014# Army Engineer Nuclear Cratering Group, Livermore, Calif.
GEOLOGIC INVESTIGATIONS AND ENGINEERING PROPERTIES OF CRATERS
Paul R. Fisher, Ronald J. Kley, and Harold J. Jack. 10 Feb. 1969. 82 p. refs.
(PNE-1103) Avail: CFSTI

The results of preshot and postshot geologic and engineering properties investigations performed in conjunction with the Project Pre-Gondola I cratering experiment series are presented. The Pre-Gondola I series consisted of the detonation of four 20-ton HE charges at varying depths of burst in highly over-consolidated Bearpaw clay shale at Fort Peck, Montana. The unweathered Bear-paw is a massive dark grey bentonitic clay shale. Alluvial and glacial overburden materials of significant thickness were found only at the Bravo site. The weathered shale was fragmented near ground surface, becoming blocky with depth. The unweathered shale was moderately jointed. Free groundwater levels were variable and were significantly influenced by fracture permeability. Detailed surface and subsurface postshot investigations were conducted at the Bravo crater. Surface postshot investigations only were conducted at the other crater sites. Pre-Gondola II preshot investigations provided postshot rupture zone information at the Charlie crater site. Bulk densities and bulking factors of ejecta and fallback material at the Bravo crater are given. Author (NSA)

N69-40039# Rome Univ. (Italy). Inst. of Physics.
ON THE METHOD OF DETERMINING THE MAGNETOSPHERIC ELECTRIC FIELD BY MEANS OF PARTICLE FLUX MEASUREMENTS
A. Egidi and G. Pizzella. 10 Jun. 1969. 12 p. *Its* Nota Interna 224.
Avail: CFSTI

A method is described for investigating the geoelectric field in the Earth's magnetosphere by measuring proton fluxes in various directions in the energy range 100 eV to 50 keV onboard a geostationary satellite. It is concluded that a particle experiment capable of determining fluxes with an accuracy of one per cent would give valuable data. ESRO

N69-40091*# Eastern Air Lines, Inc., Miami, Fla.
ATMOSPHERIC TEMPERATURE CHANGES ASSOCIATED WITH HIGH ALTITUDE TURBULENCE
Paul W. Kadlec. Jul. 1969. 27 p. refs.
(Contract NAS4-1392)
(NASA-CR-106204) Avail: CFSTI CSCL 04A

Previous research has indicated a correlation between atmospheric temperature changes and clear air turbulence in the upper troposphere and lower stratosphere. Data from 13 XB-70 test flights and military training flights were analyzed in conjunction with information compiled on commercial flights to further explore the temperature-turbulence relationship. Three cases were discussed in detail in which significant high altitude turbulence was encountered. This analysis revealed that horizontal temperature gradients of 1.0°C per 10 nautical miles depicted on meteorological constant pressure charts are indicative of moderate turbulence. Changes in isotherm orientation of 45° or more between two successive mandatory constant pressure levels appear to be related to similar intensities of clear air turbulence. This information together with vertical temperature profile criteria, may be useful in developing remote sensing devices to detect clear air turbulence in the stratosphere. Author

N69-40134# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.
SPECTRA OF INTERNAL WAVES AND TURBULENCE IN STRATIFIED FLUIDS. PART 1: GENERAL DISCUSSION AND INDICATIONS FROM MEASUREMENTS IN STABLY STRATIFIED ATMOSPHERE AND OCEAN
Yih-Ho Pao. Jun. 1969. 19 p. refs. Presented at URSI/IUCRM Colloq. On Spectra o[illegible]rol. Variables, Stockholm, 9-19 Jun. 1969
(AD-691362; D1-82-0859) Avail: CFSTI CSCL 8/3

A unified spectral description of internal waves and turbulence in stably stratified atmosphere and ocean is proposed. We envisage that the fluctuating motions in a free atmosphere with scales smaller than the synoptic scale consist of internal waves and turbulence. At low wavenumbers, internal waves predominate; this range of wavenumbers may be called the internal wave subrange. The internal waves can be identified from the characteristics of velocity-scalar co-spectra and quadrature-spectra, as shown recently by Pao in a laboratory experiment. When the internal waves are sufficiently strong and distinct, the different harmonics of internal waves may present themselves in the auto-spectra of velocity and temperature, where the peaks and valleys are clearly identifiable. This, we believe, explains the presence of peaks and valleys in some velocity auto-spectra of clear air turbulence measured in strongly stratified regions of the atmosphere. At intermediate wavenumbers (buoyant subrange), the buoyancy effect is still strong but the turbulent scrambling process becomes important; the higher-order harmonics of internal waves are no longer distinct and cannnot be detected in the auto-spectra. Author (TAB)

N69-40164# Paris Univ. (France).
CONTRIBUTION TO THE STUDY OF THE VERTICAL DISTRIBUTION OF ATMOSPHERIC OZONE [CONTRIBUTIONS A L'ETUDE DE LA REPARTITION VERTICALE DE L'OZONE ATMOSPHERIQUE]
Jean-Paul Bancarel. (Ph.D. Thesis) 27 Feb. 1969. 99 p. refs. In FRENCH. Sponsored jointly by CNES and Delegation Gen. Rech. Sci. et Tech.
Avail: CFSTI

The balloon-borne radiosonde and the telemetry devices used for studying the vertical distribution of ozone in the upper atmosphere are described. Results are presented and ozonograms compared with weather conditions four days later. The second part deals with rocket-borne equipment and the relation between ozone content and the OH-band during the daytime and at sunset is discussed. ESRO

N69-40170 Purdue Univ., Lafayette, Ind.
USE OF SIDE-LOOKING AIRBORNE RADAR IMAGERY FOR ENGINEERING SOILS STUDIES
David John Barr (Ph.D. Thesis). 1968. 206 p.
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00. Order No. 69-2886

This research report is concerned with the development and evaluation of techniques of utilizing side-looking airborne radar (SLAR) imagery for engineering soils studies. Major conclusions include: (1) the interpretation of regional engineering soil types from SLAR imagery is possible by an inference technique based on the recognition and evaluation of repetitive, unique patterns; (2) the extent to which inferences can be made concerning local land surface conditions such as local surface roughness or vegetative cover is governed by the dynamic range of tone values expressed on the imagery; a wider dynamic range permits a more detailed interpretation; (3) no evidence of significant microwave energy penetration was found on the imagery used; (4) the shape of probability density curves generated from SLAR images is a quantitative measure of visual image texture; and (5) radar shadow measurements obtained from linear image scans oriented perpendicular to the flight line can be empirically related to a terrain macroroughness factor. Dissert. Abstr.

N69-40222# Geoscience, Inc., Cambridge, Mass.
MAGNETO-TELLURIC DEEP EARTH RESISTIVITY AT EIGHT U.S. TYPE LOCATIONS
K. Vozoff, A. Orange, and H. S. Lahman. Jan. 1969. 73 p. refs.
(Contract Nonr-4900(00))
(AD-690608; RU-68011) Avail: CFSTI CSCL 8/7

Magneto-Telluric measurements were carried out in eight type-areas of the U. S., to see whether systematic differences exist in their deep crustal and upper mantle electrical resistivities. Digital recording, electrode spacings of tens of kilometers, and a frequency range of five decades were used at most locations. Results varied between those of the Adirondacks, where a resistive crust overlies a moderately conductive, strongly anisotropic mantle, to the thin resistive crust north of Spokane overlying a very thick, resistive intermediate layer. Where they can be compared with subsurface geological and electrical data our results agree with those data. In general, the Moho does not appear to be associated with a pronounced conductivity transition. Although an upper mantle conductivity increase is usual it is typically deeper than the Moho. Author (TAB)

N69-40237# Centro Nazionale di Fisica dell Atmosfera e Meteorologia, Rome (Italy).

ANOMALIES OF GEOMAGNETIC VARIATIONS OBSERVED AT MADDALENA ISLAND, SARDINIA, AND THEIR PROBABLE CAUSES

Maurizio Giorgi and Izumi Yokoyama Consiglio Nazl. delle Ric. 1968 21 p refs Quaderni de la Ric. Sci. No. 44
(CENFAM-PV-33) Avail: CFSTI

Magnetograms from Maddalena Island were examined in detail in order to investigate the anomalous short period variations of the geomagnetic vertical component there. The direction of the variations of the vertical component was found to be contrary to those at the surrounding observatories (Asiago, Mt. Capellino, Ebro, L'Aquila and Vesuvius). This characteristic was found to weaken gradually as the duration of the variations became longer, and it disappeared for variations of more than 2 hours' duration. The diurnal variations at Maddalena were normal. The anomalies at Maddalena may be attributed to the effect of the Bonifacio Straits between Sardinia and Corsica. The influence of the English Channel on geomagnetic variations at Abinger and Chambon-la-Forêt is recalled. The influence of the Bonifacio Straits on geomagnetic variations at Maddalena may be greater. In order to clarify the anomalies at Maddalena the geomagnetic variations were compared both qualitatively and quantitatively with those observed at L'Aquila, Asiago, Ebro and Fürstenfeldbruck. Author (ESRO)

N69-40239# Kiruna Geophysical Observatory (Sweden).

KIRUNA GEOPHYSICAL DATA: DATA SUMMARY 68/7–9, JULY–SEPTEMBER 1968

L. Liszka, ed. 1968 70 p
Avail: CFSTI

Measurements relating to the polar upper atmosphere conditions made at the Kiruna Geophysical Observatory during the period July–September 1968 are presented. Recorded data are: geomagnetic K-indices, magnetic pulsations, earth current amplitude values and ionospheric absorption. Magnetograms and vertical riometer records are also printed. ESRO

N69-40251# Joint Publications Research Service, Washington, D.C.

USSR ACHIEVEMENTS IN SPACE RESEARCH (FIRST DECADE IN SPACE, 1957–1967)

A. A. Blagonravov ed. 24 Jan. 1969 619 p. refs Transl. into ENGLISH of the book "Uspekhi SSSR V Issledovanii Kosmicheskogo Prostranstva. Pervoye Kosmicheskoye Desyatiletiye" Moscow, Nauka, 1968 p. 1–557
(JPRS-47311) Avail: CFSTI

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N69-40252# Joint Publications Research Service, Washington, D.C.

STUDIES OF THE UPPER ATMOSPHERE WITH ROCKETS AND SATELLITES

M. G. Kondratyev *In its* USSR Achievements in Space Res. (1st Decade in Space, 1957–1967) 24 Jan. 1969 p 16–74 refs (See N69-40251 24-13)
Avail: CFSTI

A historical review and concise overview of the basic data on the upper atmosphere obtained by Soviet scientists using rockets and satellites are presented. Some of the discoveries are: (1) The anticyclonic type of summer circulation over the central Atlantic serves as a mechanism of air exchange between the summer and winter hemispheres. (2) The inversion in the upper stratosphere during the entire polar night is attributed to a circulatory mechanism. (3) The sudden polar stratospheric warming was detected by rocket soundings. Studies of the upper atmosphere electron concentration and ionospheric composition by satellites are discussed. F.O.S.

N69-40253# Joint Publications Research Service, Washington, D.C.

SOME IONOSPHERIC STUDIES BASED ON ANALYSIS OF RADIO WAVES EMANATING FROM ARTIFICIAL EARTH SATELLITES

L. Alpert *In its* USSR Achievements in Space Res. (1st Decade in Space, 1957–1967) 24 Jan. 1969 p. 75-111 refs (See N69-40251 24-13) Avail: CFSTI

A brief outline of the development of research, and the types of radio methods used in artificial earth satellite observations is presented. The simplest type of observation is considered to be the registry of the amplitude of the received radio wave. Phase measurement permits a more thorough study of the ionospheric properties by the Doppler shift in frequencies from the rapidly moving satellite, but requires more sophisticated equipment. It is concluded that these investigations on the nature of the circumterrestrial plasma from 40,000 to 50,000 km have come in contact with interplanetary medium, and will be useful in studies of other planet atmospheres and the properties of the interplanetary medium. F.O.S.

N69-40256# Joint Publications Research Service, Washington, D.C.

STUDIES OF THE MAGNETIC FIELDS OF THE EARTH AND PLANETS

Sh. Sh. Dolginov et al. *In its* USSR Achievements in Space Res. (1st Decade in Space, 1957–1967) 24 Jan. 1969 p. 188–273 refs. (See N69-40251 24-13)
Avail: CFSTI

A concise exposition is presented of the development of concepts and problems in geomagnetism determining the first scientific programs for studying the magnetic field from satellites and space vehicles. The contributions made to solution of these problems by new experimental data obtained using magnetic and radiation instruments carried aboard satellites and space vehicles are discussed. Author

N69-40261# Joint Publications Research Service, Washington, D.C.

OPTICAL OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES AND THEIR IMPORTANCE FOR GEODESY AND GEOPHYSICS

M. K. Tikhonravov et. al. *In its* USSR Achievements in Space Res. (1st Decade in Space, 1957-1967) 24 Jan. 1969 p. 423-510 refs (See N69-40251 24-13)
Avail: CFSTI

The use of artificial satellites to mark the beginning of a qualitatively new stage in the development of astronomy, geophysics, meteorology, and biology is studied. The effects on the orbit of the atmosphere, and gravity fields of the earth and celestial bodies are discussed. Improvements in cameras, and enlargement of the observational network are reviewed. F.O.S.

N69-40289# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

INFORMATION RELATIVE TO CARTOGRAPHY AND GEODESY. SERIES 2: GERMAN CONTRIBUTIONS IN FOREIGN LANGUAGES. NO. 24: AN ASTRO-GEODETIC DETERMINATION OF THE GEOID FOR WEST GERMANY

Siefried Heitz 1969 86 p refs Submitted for publication
Avail: CFSTI

A new astronomic-geodetic determination of geoid for West Germany was started from an interpolation according to the least square method for the undulations of the geoid h with the linear set up for the autocorrelation, and the condition p_j = n source points with known deflections of the vertical, P_i = test points. For the covariance function K_{jk} of the geoidal heights h_j, h_k, where K_{jk} has to be determined empirically, it was assumed, that this function only depends on the square of the distance s on the square of the distance s_{jk} of the points P_j, P_k under consideration. When b_{jk} is the inverse matrix of the covariance matrix K_{jk} of the source points, the coefficients a_{ij} were obtained. The heights h_j of the source points were determined by an adjustment by means of the method of variation of coordinates, where the weighted sum of squares of the corrections of the components of the deflection of the vertical is made a minimum. In order to obtain the most uniform distribution of the source points, the components of the deflection of the vertical for the primary triangulation points were determined by interpolation. The computations were performed with 225 source points. Author

N69-40307# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.

NONIMAGING OPTICAL DIFFERENTIATION OF FOREST FOLIAGE

W. G. Egan Oct. 1969 40 p refs Submitted for publication
(RM-458J) Avail: CFSTI

The bidirectional first and second Stokes parameters were determined in the laboratory on a large scale polarimeter/photometer for fresh and dried red pine needles (*Pinus resinosa*) and bark, black oak (*Quercus velutina*), sugar maple (*Acer saccharum*), and peach leaves (*Prunus persica*, var. Elberta). Wave-lengths of 0.350, 0.433, 0.533, 0.566, 0.633, 0.8, and 1.0μ, determined by interference filters, were used. The data show a wide diversity of bidirectional polarimetric and photometric properties that uniquely characterize the foliage in a low resolution nonimaging sensing system. The results indicate that bidirectional Stokes parameters, implying total use of all the information in the radiation scattered by forest foliage, offer a possibility of extending the resolution limit of a system, based on a particular set of hardware components, to identify forest cover. Author

N69-40341# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF ATMOSPHERIC EFFECTS ON THE RESULTS OF LIGHT RANGE FINDER MEASUREMENTS IN ROLLING TERRAIN

A. L. Ostrovskiy et al. 26 May 1969 24 p refs Transl. into ENGLISH from Politekhn. Inst., Geod., Kartografiya i Aerofotos'yemka (USSR), no. 7, 1968 p 28-40
(AD-692148; FTD-MT-24-82-69) Avail: CFSTI CSCL 8/5

The effects of atmospheric conditions on the accuracy of electro-optical range finder measurements in rolling terrain were evaluated in August 1966. These test measurements took place at the standard polygon of the Geodetic Faculty of the Lvov Polytechnical Institute. The high-precision distance measurements were conducted between Station I, which consisted of a tripod-mounted SVV-1 model electro-optical range finder, or an OT-02 theodolite and a signal lamp, and Station II with a dual reflector, an OT-02 theodolite, and a signal lamp. An analysis of the results indicates that the relative distance measurement error over rolling terrain with a beam height of 20-60 m and known meteorological conditions at both stations is about 1:1,000,000 and may reach 1: 500,000. This error may be estimated by the method of mean integral values of air temperature along the light-beam path from zenith distance measurements made simultaneously with the range finder measurements. It is shown that atmospheric errors are at a minimum when the measurements are made at night with overcast skies and some wind. The use of range finders designed for day and night time operation tends to reduce atmospheric errors. Author (TAB)

N69-40394# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Geophysical Branch.

SEISMICITY OF WESTERN AUSTRALIA

I. B. Everingham 1968 61 p refs
(Rept-132) Avail: CFSTI

The epicentres of 238 earthquakes that occurred in the Western Australian region during the period from August 1959 to the end of June 1965 were determined. Most of these shocks were of a magnitude (M_L) less than 3.5 and occurred along a region of minor seismicity 500 kilometres long and 50 kilometres wide, which is located on the southwestern part of the shield and which may be correlated with changes in geology, geomorphology, and gravity anomalies. Instrumental and observational data collected since 1904 suggest that the most seismically active regions in Western Australia were probably in the northwestern part of the state (the Marble Bar area), the area along the Yandanooka/Cape Riche Lineament, and an area centred about 300 kilometres southeast of Carnarvon. Each of these areas is relatively close to the margin of the Precambrian shield, and earthquakes are scarce on the central part of the shield. Shocks have also occurred off the coastlines of the state on and beyond the continental shelf. Isoseismals for an earthquake that occurred on the shield near Mundaring are shown; these may be used to estimate shaking effects of other shocks similarly situated. Author

N69-40401# California Univ., San Diego. Applied Physics and Information Dept.

A COMPARATIVE STUDY OF IONOSPHERIC MEASUREMENT TECHNIQUES

Henry G. Booker and Ernest K. Smith Aug. 1969 73 p refs Prepared jointly by Environmental Science Services Administration
(AD-691866; P-4168) Avail: CFSTI CSCL 4/1

Comparisons are presented between different methods of measuring ionospheric profiles of electron-density, electron-temperature and ion-temperature. The methods compared are listed for the upper ionosphere in Table I (above 100 km) and for the lower ionosphere in Table II. Only comparisons involving

closely simultaneous observations at closely the same location are included. Below 100 km, the radio rocket method appears to have the greatest accuracy. Nevertheless, the ground-based partial reflection and wave-interaction methods need to be developed for continuous observation of electron-density profiles. Above 100 km, satellite methods, particularly the topside ionosonde, are important for obtaining global coverage. But for accuracy of measurement of electron-density, electron-temperature, ion-temperature (and several other aeronomically vital parameters), ground-based methods, particularly the incoherent backscatter radar, are superior in the altitude range 100-1000 km. Author (TAB)

N69-40447# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.

NUMERICAL EXPERIMENTS WITH HIGH-ORDER ADVECTIVE EQUATIONS

Dean Russell Morford (M.S. Thesis) Dec. 1968 58 p refs

(AD-691763) Avail: CFSTI CSCL 4/2

Second-order and fourth-order two-dimensional advective equations developed by W. P. Crowley were examined to determine their applicability to atmospheric models. One second-order and two fourth-order forms were evaluated from their performances on a simple pattern advected by a linear, divergent velocity field. The same equations were substituted for the advection term of a simple barotropic forecast model to determine their performances on more general non-linear conditions. All forms of the equations remained stable in time and demonstrated the phase and amplitude characteristics predicted by Crowley. The fourth-order advection form gave best results. When substituted in the barotropic model, the fourth-order forms lead to improved trough and low-center movements, but RMSE was slightly larger than that resulting from second-order forms. The better RMSE of the lower order forms apparently resulted from their diffusive characteristics. Author (TAB)

N69-40489# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON THE POSSIBILITY OF DETERMINING THE TYPE OF LUNAR ROCK BY A MASS SPECTROMETER METHOD

A. F. Kuzmin et al. 1969 3 p refs Transl. into ENGLISH from Kosmich. Issled (Moscow), v. 7, no. 4, 1969 p 618-619

Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method of analyzing the lunar surface composition and other atmosphere-free planets by mass spectrometry was studied by using a dynamic magnetless mass spectrometer and an electron beam evaporator. Samples of rocks were subjected to heating by a high-power electron beam, and the ionic component of the evaporation products analyzed by mass spectrometer. It is shown that for the identification of rock types, the ratios between the intensities of the K^{41} and Fe^{56} lines are the most convenient. F.O.S.

N69-40494# Brown Univ., Providence, R.I. Div. of Engineering.

CONSTITUTIVE RELATIONS FOR AN INELASTIC GRANULAR MEDIUM

J. B. Weidler, Jr. and P. R. Paslay Jun. 1969 27 p refs

(Contract ARPA SD-86)

(AD-691780; ARPA-E67) Avail: CFSTI CSCL 8/13

The results of an experimental and analytical program to develop stress-strain relations for a granular medium are presented. Explicit three-dimensional relations are given which represent the inelastic deformation of the medium. A simple version of the formulation is used to represent experimental results for a locally quarried quartz, and an evaluation of the relations is presented. The simplified relations are seen to be a compromise between mathematical tractability on the one hand and accuracy of prediction on the other. Author (TAB)

N69-40508# Paris Univ. (France). Laboratoire de Physique de l'Atmosphere.

OZONE CONTENT AT GROUND LEVEL AT VAL-JOYEUX (YVELINES) AND PORT AUX FRANCAIS (KERGUELEN ISLAND), 1967 [CONCENTRATION DE L'AIR EN OZONE AU NIVEAU DU SOL AUX STATIONS DE VAL-JOYEUX (YVELINES) ET DE PORT AUX FRANCAIS (ILES KERGUELEN), ANNEE 1967]

A. Vassy 1969 16 p In FRENCH

(Publ-1969-1) Avail: CFSTI

Atmospheric ozone partial pressure measurements recorded in 1967 at both the Val-Joyeux (France) and Port aux Francais (Kerguelen Island) stations are tabulated. ESRO

N69-40517# Danish Meteorological Inst. Charlottenlund.

AURORAL OBSERVATIONS AT THULE, 1961–1965

Christian Danielsen Mar. 1969 56 p refs Sponsored by Danish Natl. Sci. Found. *Its* Geophys. Papers No. R-9

Avail: CFSTI

The results of four years of auroral observations at Thule are presented in this report. The diurnal variation of the frequency of occurrence of auroras has a maximum in the morning at 07 UT and probably a second maximum at 10 UT. An afternoon-maximum is found at 20–22 UT in some winters. The central part of the polar cap has practically no auroral activity. The auroral forms are aligned towards the sun. Mostly, the forms are quiet and of low intensity, but movements of the forms were observed. The direction of the movements is perpendicular to the alignment of the form and from the right to the left, when looking along the form, facing the sun. The velocities are generally 300–400 m/sec. In some years there is found a positive correlation and in other years a negative correlation between the occurrence of zenithal auroras and magnetic activity. By combining the data from four winters one concludes that the state of the magnetosphere after the action of a magnetic storm may have some influence upon the formation of auroras near the center of the polar cap, but it was not possible to find any direct relation between the occurrence of zenithal auroras and local or planetary magnetic disturbance. Author (ESRO)

N69-40531# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany)

GEOID DETERMINATION BY LEAST SQUARES INTERPOLATION BASED ON MEASURED AND INTERPOLATED DEVIATIONS FROM THE VERTICAL [GEOIDBESTIMMUNG DURCH INTERPOLATION NACH KLEINSTEN QUADRATEN AUFGRUND GEMESSENER UND INTERPOLIERTER LOTABWEICHUNGEN]

Siegfried Heitz (Ph.D. Thesis-Bonn Univ.) 1968 43 p refs in GERMAN; ENGLISH and FRENCH summaries *Its* Ser. C: Dissertations, No. 124

(Rept-109) Avail: CFSTI

This method for the determination of the geoid starts from a linear setup for the autocorrelation of geoid contours. As to the covariant function of the geoid contours: it is assumed that this only depends on the square of the distance. The coefficients of the linear function of autocorrelation are determined by an adjustment by the least-square method, where the weighted sum of squares of the corrections of the deflections of the vertical is made a minimum. Author

N69-40545# Army Foreign Science and Technology Center.

INTERPRETATION OF GROUND WATER OF TYPICAL LANDSCAPES IN TURKMENIA ON AERIAL PHOTOGRAPHS

G. Ya. Meyer et al. 17 Jun. 1969 40 p Transl. into ENGLISH from the publ. "Laboratoriya Aerometodov Primenenies Aerometodov Diya Izucheniya Gruntovykh Vod" Moscow, Izd. AN SSSR, 1962 p 16-32

(AD-691566; FSTC-HT-23-498-68) Avail: CFSTI CSCL 8/8

The report gives a geographical description of the natural landscapes existing in Turkmenia and the individual landscape elements in that Soviet Republic: topography, climate, hydrography, soils and culture features. The article gives the results of aerial surveys made in the principal landscape types of Turkmenia, particular

attention in this article is given to the relationship between ground water and relief, vegetation and soils, and a description of what features serve as indicators of ground water and how these indicators appear on aerial photographs. Author (TAB)

N69-40558# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA: DATA SUMMARY, DECEMBER 1968
L. Liszka, ed. Dec. 1968 32 p
Avail: CFSTI

Measurements relating to the polar upper atmosphere conditions made at the Kiruna Geophysical Observatory during December 1968 are presented. Recorded data are: geomagnetic K-indices, magnetic pulsations, earth-current amplitude values and ionospheric absorption. Magnetograms and vertical riometer records are also printed. ESRO

N69-40567 Michigan Univ., Ann Arbor.
AN INVESTIGATION OF SEISMIC WAVE PROPAGATION IN THE EASTERN UNITED STATES
David Edwin Willis (Ph.D. Thesis) 1968 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-2408

Travel-time anomalies and attenuation losses of seismic compressional waves generated by a series of underwater explosions in the eastern United States were studied. The efficient tamping of the shots fired in water provided a seismic source that could be detected at much larger ranges than could be accomplished by equivalent sized shots fired underground. Mobile field recording stations equipped with three component matched short period seismometers and magnetic tape recorders were used to record 273 individual shots. A total of 1,295 recordings was obtained along a reversed profile. A new technique of displaying seismic attenuation data in three-dimensional space was developed that permits presentation of large quantities of data in a concise manner, hence aiding in the interpretation of the data. Consistent anomalies in the spectrum of the seismic waves were found that could be correlated with various parameters in the source region and with propagation effects. The detailed spectral studies that were made as a function of distance from the source disclosed that the attenuation of the seismic waves could be expressed by an equation. Dissert. Abstr.

N69-40572*# Kansas Univ., Lawrence. Engineering Science Div.
GEOLOGIC EVALUATION OF RADAR IMAGERY FROM DARIEN PROVINCE, PANAMA
Harold C. Mac Donald [1969] 136 p refs
(Contracts NAS9-7175; DAAK02-68-C-0089; ARPA Order 1079)
(NASA-CR-101971; CRES-TR-133-6) Avail: CFSTI CSCL 08B

The availability of extensive radar imagery covering approximately 17,000 sq. km. in eastern Panama and northwestern Colombia has provided geologic data for an area where previous geological investigations have been limited because of inaccessibility and perpetual cloud cover. The primary objectives were to: (1) determine the utility of radar in the compilation of geological reconnaissance maps; (2) define and analyze radar linears (joint systems and faults) and infer the nature of the tectonic forces responsible for certain types of local structures; (3) examine the effect of radar look direction (direction orthogonal to ground track of the aircraft) and determine if there is a factor of directional dependency with radar systems; and (4) evaluate the potential of radar as a single geological reconnaissance tool in the tropical environment and what application these imaging systems may possess for future geological reconnaissance surveys in similar geographic areas. Recognition elements of tone, texture, shape, and pattern, as well as distortions inherent to radar imagery are evaluated. Author

N69-40620 Arizona Univ., Tucson.
THE GEOLOGIC CLASSIFICATION OF THE METEORITES
Donald Parker Elston (Ph.D. Thesis) 1968 305 p
Avail:Univ. Microfilms: HC $13.75/Microfilm $3.95 Order No. 69-2012

Meteorite classes are assigned to three proposed genetic groups on the basis of a combination of compositional, mineralogical, and elemental characteristics. Transitions in structure and texture between the chondrites and achondrites are recognized. The chemical-petrologic classification of the chondrites has been modified and expanded to a mineralogic-petrologic classification of the chondrites and calcium-poor achondrites. Evidence is reviewed for the lunar origin of the pyroxene-plagioclase achondrites. On that basis of natural remanent magnetism, it is suggested that the very scarce diopside-olivine achondrites may be samples from Mars. A correlation between the four terrestrial tektite fields and four large (about 100 km) lunar ray craters is proposed. An explanation is offered for the formation of terrestrial craters that are apparently related with the three older tektite fields, and for the lack of an associated crater for the fourth, very young and very extensive tektite field. Dissert. Abstr.

N69-40729# Rome Univ. (Italy). Inst. of Physics.
ON THE DEFINITION OF THE GEOMAGNETIC L COORDINATE
G. Pizzella and C. Signorini 17 Jun. 1969 8 p refs *Its* Nota Interna 226
Avail: CFSTI

The definition given by McIlwain in 1966 for the 'L' coordinate is discussed. A new definition is proposed in which the 'L' parameter is identified as the inverse of the third adiabatic invariant and it leads to values very near to those obtained with McIlwain's definition. It is likely to prove useful in the future when the geomagnetic field will be known with better accuracy. ESRO

N69-40759 TRW Systems Group, Redondo Beach, Calif.
TRW SPACE LOG, SPRING 1969, VOLUME 9, NO. 1
William T. Pecora (Geol. Survey, Washington) 1969 26 p
Copyright. Avail: Issuing Activity

Utilization of orbital satellites to monitor and record earth's resources is discussed. The Earth Resources Technology Satellite System, based on the Nimbus Project, is described. A condensed summary is given of space projects in 1969. The total number of U.S. spacecraft launches from 1957 through March 1969 is presented. Spacecraft totals, both manned and unmanned, are listed for all countries through March 1969. R.B.

N69-40761# Geological Survey, Washington, D.C.
REMOTE SENSORS AND SATELLITES FOR THE OBSERVATION OF THOSE NATURAL RESOURCES OF THE EARTH [SENSORES REMOTOS Y SATELITES PARA LA OBSERVACION DE LOS RECURSOS NATURALES DE LA TIERRA]
William D. Carter 1969 11 p In SPANISH Presented at the 8th Congr. of Engr. of Venezuela, Caracas, 26 May 1969
Avail: Issuing Activity

The earth resources program is discussed, and the possible use of the satellite data for mineral exploration in remote areas of the Andeas is considered. Reference is made to the destructive earthquake of 1960 which destroyed and transformed large coastal areas, requiring two weeks to assess the damage. The satellite program would permit rapid and precise results for this type problem. The advantages of using satellites are shown to be: (1) synoptic view of large areas from great distances, (2) quick measurements for rapidly changing phenomenon, and (3) good opportunities for observing areas covered by water. Transl. by F.O.S.

N69-40793# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SEISMIC DISCRIMINATION Technical Summary Report, 1 Jan. - 30 Jan. 1969
Paul E. Green, Jr. 29 Jul. 1969 34 p refs
(Contract AF 19(628)-5167; ARPA Order S12)
(AD-691434; ESD-TR-69-159) Avail: CFSTI CSCL 17/10

Seismic source identification work during this reporting period has emphasized continued studies of short-period discriminants; in particular, the physical sources of some of the spectral effects observed, attempts to exploit arrays of several thousand kilometers aperture, and a probabilistic model of the two currently most promising discriminants. Author (TAB)

N69-40881# Technische Hochschule Munchen (West Germany). Fakultaet fuer Landwirtschaft und Gartenbau.
WATER SUPPLY POSSIBILITIES IN IRAN BASED ON EXISTING GEOLOGICAL AND CLIMATOLOGICAL CONDITIONS [MOGLICHKEIT DER WASSERVERSORGUNG IM KAISERREICH IRAN AUF GRUND DER BESTEHENDEN GEOLOGISCHEN UND KLIMATISCHEN VERHALTNISSE]
Seyed Esmaiel Mussawi Khessal (Ph.D. Thesis) 1969 21 p In GERMAN
Avail: CFSTI

Evaluated are various possibilities to improve the water supply in Iran by: (1) better utilization of irrigation water; (2) diminished salt content in available water; (3) cemented underground water reservoirs and surface dams in natural valleys; (4) desalination of sea water; and (5) increased surface plantings to control soil evaporation. Transl. by G.G.

N69-40893*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYDRATION, OXIDATION, AND THE ORIGIN OF THE CALC-ALKALI SERIES
Robert F. Mueller Washington Nov. 1969 32 p refs
Grant NSF GA-307)
(NASA-TN-D-5400) Avail: CFSTI CSCL 08G

A physicochemical interpretation is given for the calc-alkali differentiation series of igneous rocks as distinguished particularly from gabbroic series such as the Skaergaard complex. It is found that, contrary to previous assumptions, the oxygen fugacity decreases markedly during calc-alkaline differentiation and in this way resembles the situation in gabbroic complexes. The affinity of water for the melt has the important consequence of increasing the solubilities of the quartzofeldspathic components more than those of the ferromagnesian components, so that the phase boundaries are shifted toward lower liquidus temperatures. The result is that the courses of the crystallization paths are directed into a region of quartzo-feldspathic rather than gabbroic liquids. Author

N69-40905# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AN ASTRONOMIC-GEODETIC GEOID DETERMINATION FOR WEST GERMANY [EINE ASTRONOMISCH-GEODAETISCHE GEOIDBESTIMMUNG FUER WESTDEUTSCHLAND]
Siegfried Heitz 1969 70 p refs In GERMAN *Its* Reihe B, Angew. Geodaesie, Heft Nr. 167
Avail: CFSTI

Starting point for the geoid determination was the interpolation by least squares method of the undulations of the geoid, with a linear formulation for the autocorrelation. The covariance function of the geoid height (which was to be determined empirically) was assumed to depend solely on the square of the distance of the reference points. The heights of the reference points, unknown at first, were determined by observations and minimization of the weighted square sum of corrections to deflections from the vertical components. To achieve uniform distribution of the reference points, the deflections from the vertical for triangulation points not yet verified were interpolated and weighted 0.2, while verified points were weighted 1. The calculations are based on 225 reference points. Transl. by K.W.

N69-40906# Congress. House. Committee on Science and Astronautics.
EARTH RESOURCES SURVEYS: AN OUTLOOK TO THE FUTURE
Joseph E. Karth [1969] 10 p Presented at the WESCON/IEEE Meeting, Los Angeles, 13 Feb. 1969
Avail: Issuing Activity

A history of the Earth Resources Satellite program (ERS) is presented. The various problems encountered in developing unmanned spacecraft as opposed to the Apollo Applications Program are discussed. The requirement for a cost-benefit analysis of the Earth Resources Survey program is questioned. It is assumed that the problems which may develop in international relations will be overcome by the benefits accruing to the nations receiving the data. The greatest problem in development of the program is expected to be lack of inter-agency cooperation. The ERS program is regarded as one of the major NASA projects. R.B.

N69-40907# Geological Survey, Washington, D.C.
REMOTE SENSING RESEARCH IN THE UNITED STATES, A SUMMARY
William A. Fischer 1968 8 p refs Presented at 11th Intern. Congr. for Photogrammetry, Lausanne, Switz., 8 - 19 Jul. 1968
Avail: Issuing Activity

Remote sensing research has four objectives: (1) to improve repeatability of observations, (2) to assess time-change as a meaningful observation parameter, (3) to determine composition, and (4) to extend observations into the third dimension. All potentially useable parts of the electromagnetic spectrum are under investigation and instruments are available to "sense" in most, if not all, of the spectrum and in the various dimensions of remote sensing. It is concluded that operational use of remote sensing will increase to provide for increasing demands for timely resources survey data. Author

N69-40908# Rhode Island Univ., Kingston. Dept. of Food and Resource Economics.
SOME POTENTIAL BENEFITS TO COMMERCIAL FISHING THROUGH INCREASED SEARCH EFFICIENCY. A CASE STUDY: THE TUNA INDUSTRY
Virgil J. Norton 22 Jan. 1969 65 p refs Sponsored by the Geol. Survey
Avail: Issuing Activity

On the assumption of constant total catch, the effects of a theoretical satellite system that could reduce search time and/or increase catch per day were examined. General mathematical functions were derived to express the relationship of reduced search time and increased catch rate to operating costs and other economic measures. The reduced search time and increased catch rate could result from either direct observation of tuna concentrations or by determining environmental conditions that indicate tuna concentrations. R.B.

N69-40912# Space Data Corp., Phoenix, Ariz.
DESIGN, DEVELOPMENT AND FLIGHT TESTS OF TRIMETHYLALUMINUM, DIBORANE AND NITRIC OXIDE PAYLOADS FOR UPPER ATMOSPHERE RESEARCH Final Report, 1 Jul. 1968 - 18 Jun. 1969
Philip E. Beaudoin 20 Jun. 1969 65 p
(Contract F19(628)-69-C-0019)
(AD-691500; SDC-TM-374; AFCRL-69-0274) Avail: CFSTI CSCL 4/1

Rocket borne chemical release payloads for the release of nitric oxide, diborane, and trimethyaluminum were designed, developed and flight tested. Payload consisted of pressure vessels, fluid controls, event programmers and chemicals. Chemical handling techniques were developed and engineering field services were provided to assist with payload launchers. Author (TAB)

N69-40924*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATMOSPHERIC DENSITIES MEASURED BY THE EXPLORER 17 DENSITY GAUGES: ANALYSIS OF ERRORS AND THEIR EFFECTS UPON THE MEASUREMENTS

G. P. Newton and Richard Horowitz. Washington, Nov. 1969. 36 p. refs.
(NASA-TN-D-5447) Avail: CFSTI CSCL 04A

The atmospheric total density data from the Explorer 17 Atmospheric Density Experiment are presented. The equations used for interpretation of the gauge output currents in terms of atmospheric density are derived. Possible systematic error due to gauge calibration, energetic gas beam-surface interaction, adsorption-desorption effects, chemical compound production, and gauge nonlinearity are evaluated, and it is concluded that the previously reported density values should be increased by 35 percent. The effects of variations in atmospheric composition on the density values are as follows: If an atmosphere of 100% atomic oxygen was assumed, but the atmosphere was really 100% helium, the density values should be increased by a factor of 1.6. Correspondingly, if the atmosphere was really 100% molecular nitrogen, the density values should be decreased by a factor of 0.72. Author

N69-40939# Center for Naval Analyses, Washington, D.C. Inst. of Naval Studies.
THE CONTINENTAL SHELF
L. R. Heselton, Jr. Dec. 1968. 53 p. refs.
(Contract N00014-68-A-0091)
(AD-686703; CNA-RC-106) Avail: CFSTI CSCL 8/10

The paper describes the characteristics and extent of the world continental margin. The geological differences between the continental platforms and the ocean basins are described and portrayed. The amount and location of shallow water areas of less than 1000 fathoms (or 2000 meters) are described in detail. A bathymetric figure is shown for each area with a significant amount of shallow water. References for more detailed investigation are appended. Author (TAB)

N69-40972# Woods Hole Oceanographic Institution, Mass.
A NINE CHANNEL DIGITAL MAGNETIC TAPE FORMAT FOR STORING OCEANOGRAPHIC DATA
John A. Maltais. 7 Jul. 1969. 17 p.
(Contract N00014-66-C-0241)
(AD-691376; Rept-69-55) Avail: CFSTI CSCL 8/3

The magnetic tape format presented in this document is intended to provide a capability for describing and recording a broad range of scientific data of a numerical type. It has been designed with particular emphasis toward the storage of time series, but is also intended for storage of serial and matrix types of data in general. Author (TAB)

N69-40976# Woods Hole Oceanographic Institution, Mass.
SPATIAL CORRELATION OF OCEAN MOVEMENTS AND SOUND-VELOCITY FLUCTUATIONS
J. C. Berkerle. Repr. from J. of the Acoust. Soc. of Am., v. 45, no. 4, Apr. 1969. p. 1050 - 1051. refs.
(Contract Nonr-4029(00))
(AD-691378; Rept-69-57) Avail: CFSTI CSCL 8/3

Long period variations of sound speed at 560 m depth in the Sargasso Sea show correlations with to-and-fro movements of a ship 39 miles away that was keeping station during acoustical measurements. The results suggested that long-crested internal gravity waves may be responsible. Author (TAB)

N69-40998# Geological Survey, Washington, D.C.
GEOLOGIC APPLICATIONS OF EARTH ORBITAL SATELLITES
W. T. Pecora. 3 Jun. 1968. 22 p. refs. Presented at UN Conf. on the Exploration and Peaceful Uses of Outer Space.
(A/Conf.34/4.1; Rept-68-95441) Avail: Issuing Activity

Analyses of Gemini photographs illustrate several qualities unique to orbital photography that are of importance to geologists and other scientists in assessing natural resources. These qualities of orbital photographs include the synoptic overview of a large area within a single exposure frame, water penetration superior to that achieved on conventional aerial photographs, and near orthographic positioning of topographic and cultural features. The Earth Resources Technology Satellite (ERTS) program is a direct result of the demonstrated ability of Gemini orbital photography to earth resources studies. Such long-lived satellites will provide uniform repetitive coverage, will add the dimension of time to the interpretive process, and aid in better understanding the geological processes of earth. R.B.

N69-41011# Signals Research and Development Establishment, Christchurch (England).
ONE TO 2 MU NIGHT SKY RADIATION MEASUREMENTS IN NORTHERN SWEDEN, 17 - 30 SEPTEMBER 1967
D. Pardy and D. E. Vaughan. Oct. 1968. 30 p. refs.
(AD-691705; Rept-68023) Avail: CFSTI CSCL 4/1

The series of measurements is part of a program being conducted to determine the geographic distribution of, and the effect of local conditions on, 1 to 2 micrometer night sky radiation. Author (TAB)

N69-41076 California Univ., San Diego.
DEEP-SEA SEDIMENTATION AND CENOZOIC STRATIGRAPHY IN THE CENTRAL EQUATORIAL PACIFIC
Theodore Carlton Moore, Jr. (Ph.D. Thesis). 1968. 188 p.
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00. Order No. 69-1705

In the equatorial Pacific Ocean, fossiliferous Tertiary sediments commonly outcrop on the deep-sea floor. The occurrence of this material does not have a consistent relationship to the surrounding topography. Radiolaria from the Quaternary and Tertiary sediments of the equatorial Pacific are used in this study of stratigraphy and sediment deposition. Changes in abundance of the radiolarian species and the appearance of variants of previously described species add detail to the existing knowledge of their stratigraphy. This stratigraphy can be used to determine the relative ages of Tertiary samples. The quantitative description of radiolarian faunas can be used to indicate where sediments are being eroded, how they are mixed, and where they are being deposited. Dissert. Abstr.

N69-41106# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA: DATA SUMMARY 68/4-6, APRIL-JUNE 1968
L. Liszka, ed. 1968. 67 p.
Avail: CFSTI

Measurements relating to the polar upper atmosphere conditions made at the Kiruna Geophysical Observatory during the period April-June 1968 are presented. Recorded data are: geomagnetic K-indices, magnetic pulsations, earth current amplitude values and ionospheric absorption. Magnetograms and vertical riometer records are also printed. ESRO

N69-41108# Institute of Modern Languages, Inc., Washington, D.C. Translation and Interpretation Div.
THE PACIFIC OCEAN. VOLUME 4: THE PACIFIC COASTS
V. P. Zenkovich. Apr. 1969. 135 p. refs. Transl. into ENGLISH from the book "Tikhii Okean, Vol. 4, Berega Tikhogo Okeana" Moscow, Nauka, 1967. p. 236 - 278, p. 330 - 357.
(Contract N62306-69-M-0080)
(AD-686911) Avail: CFSTI CSCL 8/10

Contents: North America; classification of types of Pacific Ocean coasts; some general features in the development of the coastal zone of the Pacific Ocean. TAB

N69-41126# Air Force Cambridge Research Labs., Bedford, Mass.
GEOPHYSICS AND SPACE DATA BULLETIN, VOLUME 6, NO. 1
Anne L. Carrigan, ed. 1969. 352 p. refs.
Avail: CFSTI CSCL 4/1

CONTENTS:
1. TOTAL FIELD INTENSITY MAGNETOMETER P. Prevett

(Weston Obs.) and F. de Mendonca (Sao Jose Dos Campos) p 3-12 (See N69-41127 24-14)

2. COSMIC RAY NEUTRON INTENSITY MONITOR J. A. Simpson (Chicago Univ.) and J. A. Lockwood (New Hampshire Univ.) p 13-47 refs (See N69-41128 24-29)

3. EXTREMELY LOW FREQUENCY NOISE C. Polk (Rhode Island Univ.) and H. Koenig (Tech. Univ.) p 49-58 refs (See N69-41129 24-07)

4. RIOMETER R. J. Cormier p 59-83 refs (See N69-41130 24-14)

5. SOLAR OPTICAL PATROL OBSERVATIONS H. L. DeMastus and A. Abrami (Trieste Astron. Obs.) p 85-135 refs (See N69-41131 24-39)

6. SOLAR RADIO EMISSION p 137-297 refs (See N69-41132 24-29)

7. VERTICAL INCIDENCE IONSPHERIC SOUNDINGS K. Rawer (Ionospharen Inst.) and K. Bibl (Lowell Technol. Inst.) p 299-359 refs (See N69-41133 24-13)

N69-41133# Air Force Cambridge Research Labs., Bedford, Mass.
VERTICAL INCIDENCE IONOSPHERIC SOUNDINGS
Karl Rawer (Ionospharen Inst., Breisach, W. Germany) and Klaus Bibl (Lowell Technol. Inst., Mass.) *In its* Geophys. and Space Data Bull., vol. 6, no. 1 1969 p 299-359 refs (See N69-41126 24-13)
Avail: CFSTI

Absorption loss data are tabulated from the Freiburg, Germany site, as well as median values which are important in describing ionospheric electron density. Median curves and hourly values are also included from data obtained from a C-4 ionosonde operated at Billerica, Massachusetts in the 1.7 MHz to 14 MHz frequency range. A.C.R.

N69-41162*# Allied Research Associates, Inc., Concord, Mass.
USE OF NIMBUS 2 APT TO DETERMINE THE RATE OF ICE DISINTEGRATION AND DISPERSION IN HUDSON BAY
C. J. Bowley Mar. 1969 43 p refs
(Contract NAS5-10343)
(NASA-CR-106478; Rept-9G45-31; TR-8) Avail: CFSTI CSCL 08F

Analysis of Nimbus 2 APT photographs for the period of 16 May-15 July 1968, when either all or a part of the Hudson Bay region was cloud free, indicates that the satellite can provide operationally useful information on ice disintegration and eventual dispersion. In this region during spring a totally cloud free satellite observation can be expected once every four or five days. In most cases, ice cover can be reliably identified and differentiated from cloud cover without referring to conventional data. Also, it appears that the ice distribution can be mapped with reasonable accuracy. Identification of numerous geographic features along the coastline enabled extremely accurate one degree grid overlays to be prepared. Relatively small changes on the ice limit were readily detected. Author

N69-41177# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE POSSIBILITY AND ADVANTAGES OF A MASS SPECTROMETER ANALYSIS OF MATERIALS OF THE LUNAR GROUND BY THE IONIC COMPONENT OF EVAPORATION
A. F. Kuzmin et al. 1969 3 p ref Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 7, no. 4, 1969 p 620-622
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Described is a mass spectrometric analysis of the lunar soil composition which is based on utilizing the ionic component of evaporation products together with simultaneous application of an electric field to draw in ions. The investigations are conducted on an apparatus containing a highly productive evacuating unit, a fast response dynamic mass spectrometer, and an electric beam evaporator. Results showed that the intensity of the mass spectra of the ionic component of the evacuation product is greater than the intensity of mass spectra obtained in ionizing a beam of molecules of the neutral component in the ion source of the mass spectrometer; the possibility of superposition of gas background lines on the mass spectrum of the ground is eliminated. G.G.

N69-41192 National Lending Library for Science and Technology, Boston Spa (England)
SPECTROPHOTOMETRIC STUDIES OF THE CHARACTERISTICS OF ATMOSPHERIC AEROSOL IN DIFFERENT GEOGRAPHICAL REGIONS OF THE USSR
G. P. Gushchin 20 Jul. 1969 42 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), No. 223, 1968 p 65-80 (NLL-M-7734-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl., 4 NLL photocopy coupons

The atmospheric aerosols in different regions of the U.S.S.R. were investigated in the spectral range of 3500 to 6500 Å. The M-83 ozonometer and the procedures which were used to measure the optical characteristics of the aerosols in different parts of the spectrum are described. The acquisition of data in the lower levels of the atmosphere is considered necessary since the particles distribution does not obey Junge's formula, and is affected by the ground surface and local particle sources. It is concluded that the optical thickness of an aerosol is independent of wavelength, and that the Central Asian optically active aerosol is formed comparatively large and dry powdery particles. F.O.S.

N69-41211# Geological Survey, Washington, D.C.
SPACE APPLICATIONS IN WATER RESOURCE DEVELOPMENT
Charles J. Robinove [1969] 21 p refs Presented at the UN Conf. on the Exploration and Peaceful Uses of Outer Space, Vienna, 14-27 Aug. 1968
Avail: Issuing Activity

The worldwide tasks of water resource development are discussed, and the usefulness of space sensing methods for hydrologic purposes is assessed. Present and potential uses of remote sensing and space data are considered, including data communication via satellite relay and recommendations for future programs. An evaluation of the various applications of remote sensors as hydrological tools covers techniques and data available for measurements of the physical characteristics of water surfaces and of the chemical and biological characteristics of water, snow surveying and glaciology, mapping of ground water features, geomorphology surveys, and measurements of the liquid-vapor transfer in the hydrologic cycle. The techniques evaluated are panchromatic, multispectral, infrared, color, and infrared-color photography; infrared radiometry and imagery; radar imagery; and microwave radiometry and imagery. K.W.

N69-41239*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THERMAL ANOMALIES AND GEOLOGIC FEATURES OF THE MONO LAKE AREA, CALIFORNIA, AS REVEALED BY INFRARED IMAGERY
Jules D. Friedman Sep. 1968 93 p refs Prepared by the Geological Survey
(NASA Order R-146-09-020-006)
NASA-TM-X-61945; NASA-TL-82) Avail: CFSTI CSCL 08F

The Mono Lake area, California, was selected for airborne infrared scanning radiometer experiments because of the exposure in this area of a variety of lithologies having different physical and thermal properties as well as a diversity of textural and morphologic features. Infrared surveys were undertaken in 1965 and 1966 to measure variations in the infrared emission from the surface in the 4.5 - 5.5μ and 8-14μ bands. Areal variations in emission from the surface were registered on film as differences in image tonal density. In addition, variations of surface radiant temperature with time during the diurnal cycle were recorded at several selected localities. Author

N69-41250# Library of Congress, Washington, D.C. Aerospace Technology Div.
SOVIET PHOTOGRAMMETRY SURVEYS OF FOREIGN SCIENTIFIC AND TECHNICAL LITERATURE
Alexander Bobrovsky 30 Jun. 1969 24 p refs
Its Work Assignment No. A-69-12
(AD-691365; ATD-69-71) Avail: CFSTI CSCL 8/2
Contents: Applications of photogrammetric surveying methods; Photogrammetric measurements; Aerial surveying and photography; and Photogrammetric instrumentation. TAB

N69-41274# Montana State Coll., Bozeman. Engineering Research Labs.
FREQUENCY OF PEAK FLOWS PREDICTED FROM RAINFALL FREQUENCIES Interim Report
Lee Robinson and T. T. Williams Aug. 1968 122 p refs
Sponsored by the Bureau of Public Roads and Montana State Highway Commission
(PB-183693; IR-7) Avail: CFSTI CSCL 08H
A preliminary study based mainly on Gumbel's first asymptotic extreme value distribution for rainfall intensities and peak discharge rates was made to correlate the frequencies of peak flows and rainfall. A prediction equation for estimating the peak total discharge was suggested. This method was tested on Montana watersheds east of the continental divide. USGRDR

N69-41280# Bureau of Sport Fisheries and Wildlife, Washington, D.C.
SPACECRAFT FOR FISHERY RESEARCH
Paul M. Maughan [1968] 20 p refs
(Rept-7.5/I) Avail: Issuing Activity
The use of spacecraft for remote sensing of fish stocks is discussed in the visible, infrared, and microwave frequencies. Spacecraft for fishery research is proposed for directly detecting large, near-surface schools of fish, and observing and recording environmental phenomena that are related to the abundance and distribution of fish stocks. It is concluded that repeated coverage would permit the determination of the movement and migration patterns so that once identified, the fish could be accounted for at all times, and any system would require that each commercial fishing vessel have an inexpensive receiver aboard for satellite information. F.O.S.

N69-41309# Geological Survey, Washington, D.C. Ground Water Resources Inst.
EROS: INVESTIGATIONS FROM SPACE
William A. Fischer 1969 3 p *Its* Vol. 2, No. 1
Avail: Issuing Activity
The remote sensor system requested by the Department of the Interior is briefly described, as well as other improved aircraft and/or spacecraft sensor designs. The system is intended for placement in earth orbit for earth resources observation, and the potential contributions of its data to ground water studies will also be evaluated. A.C.R.

N69-41331 Princeton Univ., N.J.
PALEOMAGNETISM OF THE STILLWATER COMPLEX, MONTANA
Hugh W. Bergh (Ph.D. Thesis) 1968 207 p
Avail: Univ. Microfilms, HC $9.45/Microfilm $3.00 Order No. 69-2722
A total of 167 oriented cores have been drilled at fifteen localities in the Stillwater layered intrusion in Montana. Fifteen sites were sampled on the East Boulder Plateau along Hess' (1960) section and a further three sites in the Mouat Mine area, twelve miles to the east. Directions of natural remanent magnetization are widely scattered at most localities. Demagnetization in alternating magnetic fields of up to 800 oersted has proved successful in removing large secondary components of magnetization. Nine of the sites have very similar directions of magnetization after magnetic cleaning. This is considered to be the thermoremanent magnetization acquired at the time of initial cooling of the intrusirn (3,100 ± 200 million years). Evidence is thus provided for the first time for the existence of a geomagnetic field at this remote period in the history of the earth. Dissert. Abstr.

N69-41348# International Geophysical Year World Data Center A, Washington, D.C.
CATALOGUE OF DATA IN WORLD DATA CENTER A. GRAVITY, TSUNAMI, SEISMOLOGY, LONGITUDE AND LATITUDE, METEOROLOGY: DATA RECEIVED BY WDC-A DURING THE PERIOD 1 JULY 1957–31 DECEMBER 1968
Mar. 1969 63 p refs
(PB-183860) Avail: CFSTI CSCL 08K
The report consists of the World Data Center A Catalogue of Data for Gravity, Tsunami, seismology, Longitude and Latitude, and Meteorology for the period ending 31 December 1968. USGRDR

N69-41351# Maryland Univ., College Park. Dept. of Physics and Astronomy.
AN EXPERIMENT RELATIVE TO THE VERTICAL DISTRIBUTION OF ATMOSPHERIC OZONE Final Report, 1 Mar. 1966 - 31 Mar. 1969
R. T. Bettinger and J. Bohse Jan. 1969 81 p refs
(Grant CWB-WBG-80)
(PB-183814) Avail: CFSTI CSCL 04A
The primary objective of the report was to investigate the problems associated with an experiment to measure the vertical distribution of ozone from a satellite. Several other topics have received attention, including cloud height measurements and cloud penetration studies. A study in numerical analysis relative to the inversion process in the ozone problem was conducted. Author (USGRDR)

N69-41353# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
THE GEOLOGY OF THE DUARINGA AND SAINT LAWRENCE 1 TO 250000 SHEET AREAS, QUEENSLAND
E. J. Malone, F. Olgers, and A. G. Kirkegaard (Geol. Survey, Queensland, Australia) 1969 181 p refs
(Rept-121) Avail: CFSTI
A detailed geophysical survey of a natural basin formation in Australia is given that contains a Permian sequence structure complexly related to pre-Permian rocks of many ages. The oldest rocks in the area are possibly Lower Palaeozoic and were block faulted into approximately their present position during the Lower Permian. The area was mapped as part of a regional survey by aerial photography, and graphic and seismic measurements. Emphasis was placed on the various rock formations and possible mining resources. G.G.

N69-41391 Missouri Univ., Columbia.
THE ROLE OF INFLECTIONAL INSTABILITY IN THE COMPRESSIBLE HETEROGENEOUS ATMOSPHERE
Ernest Mason Agee (Ph.D. Thesis) 1968 81 p
Avail: Univ. Microfilms, HC $4.40/Microfilm $3.00 Order No. 69-3211
Observational studies of banded cloud occurrences and associated temperature and velocity profiles over central Missouri during the past several years revealed some cases not compatible with any existing theoretical explanation. In considering the instability of the ripples and waves in the middle- and upper-tropospheric wind field associated with these cloud bands it is hypothesized that the instability mechanism is related to the variable vertical wind shear, a prominent feature by the atmospheric structure in such cases. By placing emphasis on the role of variable vertical wind shear an attempt is made to extend the concept of Rayleigh in-shear an attempt is made to extend the concept of Rayleigh inflectional instability to the compressible, heterogeneous atmosphere. A mathematical model of the atmosphere is presented in which the properties of fluid compressibility and density stratification are incorporated. Dissert. Abstr.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N69-40009# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

UNIFIED FILM TRANSPORT MECHANISM (UFT) OF THE CAMERA FOR WORK WITH THE 50 mm NONPERFORATED FILM

M. Maly, S. F. Belyakov, and S. Vyskochil. 1969. 18 p.
(JINR-P13-4474) Avail: AEC Depository Libraries

A film transport mechanism for a camera, intended for use in bubble and spark chambers in dangerously explosive conditions as well as in a strong magnetic field, is described. The drive of the mechanism is pneumatic, the maximum size of the frame is 150 × 50 mm. The data necessary for designing the apparatus using UFT-50 are presented. Author (NSA)

N69-40010# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.

DIGITAL LEAK-RATE GAGE

D. H. Gray. 26 Jun. 1969. 24 p.
(Contract W-7405-ENG-26)
(Y-1671) Avail: CFSTI

An instrument called a digital leak-rate gage was developed for determining porosity and was placed in operation at the Oak Ridge Y-12 Plant. This device will read electronically the position of an indicator float in an air column and provide a direct digital display and card-punch readout. Author (NSA)

N69-40036*# Martin Marietta Corp., Denver, Colo.

METEOROID PENETRATION DETECTOR DEVELOPMENT PROGRAM, VOLUME 1 Final Summary Report

Sidney L. Russak, Rufus O. Moses, Del Gray, and Russell L. McCord. Oct. 1969. 369 p. refs.
(Contract NAS1-7043)
(NASA-CR-66840) Avail: CFSTI CSCL 14B

Meteoroid penetration detectors were designed, fabricated, and qualification-tested. These detectors were developed for flight on the Advance Meteoroid Project (AMP) satellite planned by NASA - LRC. The detectors consist of pressurized chambers fabricated from stainless steel target material and utilize a pressure switch for puncture detection. This program is an outgrowth of the S-55 and Pegasus projects and utilizes the pressure-cell detector concept of the S-55 project. Detectors were developed in stainless steel material thicknesses of 0.002 to 0.042 in. Author

N69-40054*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DEVELOPMENT OF A SKIN-FRICTION BALANCE TO INVESTIGATE SOURCES OF ERROR IN DIRECT SKIN-FRICTION MEASUREMENTS

James G. Fowke (M.S. Thesis - Va. Univ.) Jun. 1969. 72 p. refs
(NASA-TM-X-61905) Avail: CFSTI CSCL 14B

The development of a force transducer for use in wind tunnels to study attendant errors associated with skin-friction measurements is discussed. This unique instrument incorporates a closed-loop control system to measure skin-friction force. The force acts tangent to the surface of a five-inch-diameter sensing element over which wind-tunnel air flows. A linear force motor exerts a restoring force which nulls the position of the sensing element. The applied skin-friction force is measured by sensing the quantity of direct current through the motor necessary to achieve null position. A dummy skin-friction balance is described which was designed and constructed to measure loads which act perpendicular to the skin-friction sensing element during tunnel starts and during flow breakdown. Results of wind-tunnel experiments conducted with the dummy balance are presented. Author

N69-40059*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FLOW-DIRECTION MEASUREMENT WITH FIXED-POSITION PROBES

Thomas J. Dudzinski and Lloyd N. Krause. Washington, Oct. 1969. 16 p. refs
(NASA-TM-X-1904) Avail: CFSTI CSCL 14B

Because of space limitations and system complexity in many aeronautical applications, movable probes cannot be used to measure flow direction. This report presents correlations between measured fixed-probe pressures and airflow direction over a range of Reynolds number, Mach number, and flow angle. Flow direction is measurable to within about 1° over combinations of flow conditions in the range $1000 \leq Re \leq 40\,000$, $0.3 \leq M \leq 0.9$, $-30° \leq \text{angle} \leq +30°$. Author

N69-40139# Stanford Univ., Calif. Physics Dept.

TOTAL ABSORPTION DETECTORS FOR HIGH AND SUPER HIGH ENERGY PHYSICS

Robert Hofstadter. Mar. 1969. 42 p. refs
(Contract Nonr-225(67))
(AD-690761; HEPL-599) Avail: CFSTI CSCL 18/4

Contents: TASC detectors for electromagnetic or Type A particles; Performance of TASC detectors; TANC detectors for strongly interacting or Type B particles; Outlook for the future. TAB

N69-40144# Douglas United Nuclear, Inc., Richland, Wash.

COMPUTATION OF TEMPERATURE SENSOR RESPONSE CHARACTERISTICS USING ANALYSIS OF TRANSIENT TEMPERATURE INFORMATION

A. A. Leventis. May 1969. 17 p. Presented at the 15th Ann. Meeting of the Am. Nucl. Soc., Seattle
(DUN-SA-101; CONF-690609-17) Avail: CFSTI

A description of resistance temperature detectors (RTDs) which are used for temperature input signals to reactors is given. Response characteristics and methods of determining these are discussed. The mathematical model for describing the impulse response of the RTD is formulated; procedures for obtaining the driving function are outlined. A sample problem is included, and data are shown graphically. NSA

N69-40151# Laboratoire de Recherches Balistiques et Aérodynamiques, Vernon (France).

ACCEPTANCE TESTS OF TWO HEWLETT-PACKARD TYPE 3420 B (NOS. 493 AND 500) DIFFERENTIAL VOLTMETERS [ESSAIS DE RECETTE DE DEUX VOLTMETRES DIFFERENTIELS HEWLETT-PACKARD TYPE 3420 B, NO. 493 ET NO. 500]

2 Jun. 1969. 70 p. refs. In FRENCH
(LRBA-E-520-PV-3/SEV/SI) Avail: CFSTI

Acceptance tests were carried out on two Hewlett-Packard type 3420 B differential voltmeters and the instruments, methods and results are presented. It was found that the voltmeters complied with the performances indicated by the manufacturer and with the needs of the laboratory. ESRO

N69-40197*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PERFORMANCE OF THE NIMBUS 2 MEDIUM RESOLUTION RADIOMETER

Musa Pasternak. Sep. 1969. 27 p. refs. Submitted for publication
(NASA-TM-X-63708; X-622-69-372) Avail: CFSTI CSCL 14B

Average radiation values for a 10° latitude-15° longitude global grid were obtained for all five channels of the Nimbus II medium resolution radiometer for the lifetime of the radiometer May 15, 1966 to July 30, 1966. The temperature measurements from the 10 - 11 μ and the 5 - 30 μ channels showed respective average day - night temperature differences of 3.2°K and 1.9°K. The average temperature measurements for the 6.4 - 6.9 μ, 10 - 11 μ, and the 5 - 30 μ channels associated with 25° - 45° nadir angles were 2.2°K less than those associated with 0 - 25° nadir angles.

However the total outgoing long-wave radiation calculated from the 5 – 30μ data did not show any significant limb effect. The meridional temperature profiles of the channels measuring long-wave radiation showed a temperature minimum near 5°N, a temperature maximum near 25°N, and a higher temperature maximum near 15°S. The meridional reflectance profiles for the 0.2 – 4.0μ channel generally showed reflectance trends in an opposite direction from those of the long-wave radiation, except that the reflectance minimum near 15°N was displaced from the long-wave maximum at 25°N. Author

N69-40203*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
APOLLO 9 MULTISPECTRAL PHOTOGRAPHY: GEOLOGIC ANALYSIS
Paul D. Lowman, Jr. Sep. 1969 57 p refs
(X-644-69-423)
(NASA-TM-X-63714) Avail: CFSTI CSCL 14E

The Apollo 9 mission carried a multispectral terrain photography experiment in which the astronauts photographed selected land areas with an array of four 70 mm cameras, each with a different filter/film combination, in an effort to determine the feasibility and value of multispectral orbital photography for earth resources studies. Presented are results of a geological study of selected sets made to determine if multispectral orbital photography offers any advantages for geology over comparable color or panchromatic orbital photography. Visual comparison of four-camera sets showed that multispectral photography was definitely superior in rendering geological structures of heavily vegetated areas and permitted easy differentiation among deciduous vegetation, open water, and rock or soil. An Ektachrome infrared picture of California's Elsinore fault established its dominantly dip-slip rather than strike-slip structure. Author

N69-40218# Army Foreign Science and Technology Center, Arlington, Va.
AERIAL PHOTOGRAPHIC METHOD FOR STUDYING GROUND WATER [PRIMENENIE AEROMETODOV DLIA IZUCHENIIA GRUNTOVKH VOD.]
G. Ye. Meyer 1969 21 p refs Transl. into ENGLISH from the book "Primenenie Aerometodov Dlia Izucheniia Gruntovkh Vod." Moscow, Akud. Nauk SSSR, 1962 p 4 – 15
(AD-690613; FSTC-HT-23-479-68) CSCL 8/8

This paper presents a general review of the use of the aerial photographic method in the search for ground water in various parts of the Soviet Union. The individual indicators of the presence of ground water shown on aerial photographs are individually discussed; these include such features as vegetation, relief, culture features and many others. The article discusses the most useful scales of photography, cameras, light filters, aircraft, proper season for conducting the work, most suitable weather and best time of day. Specific work in this field is discussed, particularly that done in Turkmenia and the Caspian Lowland, but this is also contrasted with work done in other landscape regions of the country. The various criteria used in different regions of the USSR are listed. Specific aspects of the field work which supplements aerial photography are in some detail. The significant role of the geobotanical method is discussed, followed by some comments on the preparation of interpretation keys and photomosaics and the role played by black and white and color prints. Author (TAB)

N69-40299# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF MEASURING WEAR OF PARTS WITHOUT DISMANTLING MACHINES
2 Jun. 1969 3 p Transl. into ENGLISH from Morsk. Flot (Moscow), no. 2, 1968 p 33
(AD-692159; FTD-HT-23-150-69) Avail: CFSTI CSCL 14/2

The usual method of measuring wear of parts involves the use of radioactive isotopes and this entails some danger as well as requiring a great many recorders. A method of measuring wear is described by which a capacitance pickup is glued flush with the face of the part subjected to wear. Wear is judged by the drop in capacitance of the pickup due to progressive wear. Direct recording of the changes in capacitance yields a curve characterizing wear and permits determining completion of run-in and the start of normal operation of machine parts. Author (TAB)

N69-40310# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SINGLE-CHANNEL ULTRASONIC LIQUID FLOWMETER
M. A. Tunanov et al 4 Jun. 1969 5 p Transl. into ENGLISH from Russian Patent no. 211813 (Appl. no. 1009910/26-10, 18 May 1965) 2 p
(AD-691669; FTD-HT-23-120-69) Avail: CFSTI CSCL 14/2

An Author Certificate has been issued for a single channel ultrasonic flow meter for liquids such as oil and oil products. The device contains two piezoelectric elements with acoustic lines, a high frequency master oscillator, a switching-pulse generator, modular and selector amplifiers, and a phase detector. To increase accuracy, the acoustic lines are made in polyhedron form with mirror-reflecting surfaces, and the selector amplifiers are connected to the phase detector through amplitude-limiting and final cascades. Author (TAB)

N69-40337# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
INFORMATION RELATIVE TO CARTOGRAPHY AND GEODESY. SERIES 2: GERMAN CONTRIBUTIONS IN FOREIGN LANGUAGES. NO. 23: DETERMINING ATMOSPHERIC REFRACTION FROM THE DISPERSION OF LIGHT
Rudolf Brein 1969 16 p refs Submitted for publication
Avail: CFSTI

After discussing the theory of ray curvature of different colors, an instrument designed to determine the angle of refraction is described. Reports on the results obtained with this instrument at target distances of 6 to 18 km are given. The difference method which was proved successful with this instrument may also be applied to the determination of the refractive index in distance measurements. Author

N69-40343*# Techtran Corp., Glen Burnie, Md.
DEVELOPMENT OF AN ALL-ELECTRONIC STAR SENSOR WITH IMAGE DISSECTOR TUBE [ENTWICKLUNG EINES VOLLELEKTRONISCHEN STERNSENSORS MIT IMAGE-DISSECTOR-ROHRE]
W. Bross Washington NASA Oct. 1969 18 p refs Transl. into ENGLISH from German Reports BMwF-FB, W68-76
(Contract NASw-1695)
(NASA-TT-F-12646; BMwF-FB-W-68-76) Avail: CFSTI CSCL 14E

The construction and method of operation of the image-dissector tube is briefly described and the most important requirements for the scanning process in a star sensor are listed. A new kind of scanning process is introduced which automatically switches from the search mode to the lock-on mode when a star is discovered. The scanning rate is very high in the lock-on mode and the margin of error is therefore low. Drift errors are not possible in this system. An experimental star sensor which uses this scan method is described and the experimental results are presented. On-axis accuracy is excellent while off-axis accuracy is only limited by the imperfections of the electron lens and the deflection yoke. Author

N69-40387# Army Foreign Science and Technology Center, Washington, D.C.
A DEVICE FOR NON-BRAKING DETERMINATION OF ENGINE OUTPUT
N. S. Zhdanovskii et al 18 Jun. 1969 7 p Transl. into ENGLISH from Byull. Izobret. Tovarnykh Znakov (Moscow), no. 7, 1968
(AD-691312; FSTC-HT-23-1064-68) Avail: CFSTI CSCL 14/2

The article describes a device to determine the output of an engine without braking it. The device is used on an internal combustion tractor engine with a hydraulic suspension system. The device consists of an attachment with a needle valve mounted on the fuel line in front of the fuel injector to draw off fuel during cylinder cutoff. The mechanical losses in the cylinder are the load of the operating cylinders. The device also uses an attachment with a choke to change oil pressure in the injection line during adjustment of the load which is determined by a pressure gauge mounted on the device. Such an arrangement permits increasing the accuracy of determining engine output at different modes under field conditions. TAB

N69-40493*# Minnesota Univ., Minneapolis.
AUTOMATED STELLAR PROPER MOTION MEASURING MACHINE Monthly Progress Report, Aug. - Sep. 1969
14 Oct. 1969 35 p
(Contract NSR-24-005-062; CDC Proj. 95640)
(NASA-CR-106348) Avail: CFSTI CSCL 14E

Major efforts were made to improve the automated stellar motion measuring machine. Work was concerned primarily with designing, encoding, testing, and debugging programs. The programs goal, providing accurate data which requires minimum scanner corrections, was met satisfactorily. Author

N69-40528 Virginia Univ., Charlottesville.
ADAPTING THE GENERATING ELECTRIC FIELD METER TO THE MEASUREMENT OF WORK FUNCTIONS
Harold Dickenson Browning (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-18181

The generating electric field meter, normally used to measure the earth's electric field, has been converted to a dual probe-and-field-electrode configuration. A sectored rotor synchronously cuts the electric field between each probe-electrode pair, and this generates two ac signals which are fed into a differential preamp. With the probes at a common potential the resultant ac output is generated by the potential difference between the two-field electrodes. Application of appropriate dc bias to one of the electrodes enables the ac output to be nulled out, and the amount of bias is a measure of the contact potential difference between the two electrodes. If the work function of one material is known, the work function of the other may be obtained. Included is a discussion of other methods used to measure work functions, and also a synopsis of the effects various surface contaminants have on the work function. Accuracies of ±0.05 volts have been obtained, and using platinum as a reference measured values of work functions for polycrystalline surfaces compare closely with published data available. Dissert. Abstr.

N69-40571*# Westinghouse Electric Corp., Pittsburgh, Pa.
DISPLAY PROCESSOR FOR IMPROVED APOLLO TV CAMERA Final Report
10 Oct. 1969 6 p
(Contract NAS9-8787)
(NASA-CR-101973) Avail: CFSTI CSCL 14E

The shipping delay of the display processor for the improved Apollo TV camera was caused primarily by a mishap which resulted in considerable damage to the machine, and secondarily by the correction of flaws in performance discovered during testing and calibration. Further, it was considered necessary to repeat all of the test and calibration that had been carried out before the mishap so that any damage caused by the accident would be certain to be detected. All of the defects and deficiencies that were discovered in this comprehensive testing program were completely cured and some additional test equipment used in the program, was mounted permanently in the recorder to simplify future test operations. Author

N69-40730# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
NOTE CONCERNING THE USE OF SILICON PHOTO-DIODES IN A SCINTILLATOR DETECTOR [MISE AU POINT CONCERNANT L'UTILISATION DE PHOTO-DIODES AU SILICIUM DANS UN DETECTEUR A SCINTILLATION]
Robert Verdant Aug. 1969 37 p refs In FRENCH; ENGLISH summary
(CEA-BIB-169) Avail: CFSTI

This literature survey establishes the conditions under which it is possible to use a silicon photo-diode in conjunction with a scintillator. The main parameters involved, spectral response, sensitivity, noise and optical coupling are discussed and the results obtained by different workers are summarized and compared. The prospects of a development in association with collection or charge-multiplier diodes are considered. An attempt is made to define the practical limits of using the device which appears to be the spectrometry of heavy charged particles above a certain energy. Author (ESRO)

N69-40756# Arizona Univ., Tucson. The Steward Observatory.
THE STEWARD OBSERVATORY 90-INCH REFLECTOR
R. L. Hilliard 23 Jun. 1969 15 p
Avail: Issuing Activity

The historical background of the 90-inch reflector telescope is given. The telescope building is 87 feet high with the declination axis of the telescope 60 feet above ground level, which minimizes the detrimental effects of heat currents near the ground on the image quality. The building design contains unique features in the telescope pier and dome. Precision auxiliary equipment is coupled with the optical system of the telescope to enhance detection and measurement of stellar objects. Enlargements of photographic test plates of some objects are included. R.B.

N69-40788# National Bureau of Standards, Boulder, Colo.
STANDARD TIME AND FREQUENCY: ITS GENERATION, CONTROL, AND DISSEMINATION FROM THE NATIONAL BUREAU OF STANDARDS TIME AND FREQUENCY DIVISION
John B. Milton Aug. 1969 33 p
(NBS-TN-379) Avail: SOD $0.35

The Time and Frequency Division of the National Bureau of Standards produces the NBS time scales, atomic time scale, stepped, atomic scale, and universal time scale. These time scales are developed by utilizing the properties of the NBS frequency standard, NBS-III. The main byproduct of these time scales is the operational clock systems. These operational clock systems are used, among other things, to calibrate the clocks and secondary standards necessary for the operation of the NBS radio stations, WWV, WWVB, WWVL, and WWVH. These stations transmit stepped atomic scale, universal time scale, and various tones, alerts, and corrections for time-of-day information. Author

N69-40798*# Bellcomm, Inc., Washington, D.C.
DYNAMIC DISTORTION OF A GIMBALED TELESCOPE
G. M. Anderson 21 May 1969 48 p refs
(Contract NASw-417)
(NASA-CR-106457; TM-69-1022-3) Avail: CFSTI CSCL 17H

The structural distortion of an orbiting telescope is determined for a suddenly applied ramp function of displacement of the gimbal resulting from a worst case astronaut impulsive translation. Translational decoupling of the telescope from the spacecraft by means of springs is included in the analysis, and it was shown that this method can reduce dynamic distortion to any desired level, even below 0.01 seconds of arc. The telescope structure is modeled as a prismatic beam and the Timoshenko beam equations are solved using the Laplace transformation for both the space and time variables. A proof is given that the integrand of the inversion integral is always single valued for beams of finite length. The residue theorem may therefore be applied without the need for integration around branch cuts. The treatment of the applied load

as a boundary condition in shear is employed in the analysis. This method was the occasion of error and discussion in the literature. Author

N69-40799*# Bellcomm, Inc., Washington, D.C.
APOLLO 8 COLORIMETRY
A. F. H. Goetz 11 Mar. 1969 10 p refs
(Contract NASw-417)
(NASA-CR-106458; TM-69-2015-3) Avail: CFSTI CSCL 14E

The results of the two color CSM photographic experiments aboard Apollo 8 are discussed. Operational problems precluded obtaining data useful for data analysis by image processing. The image processing technique applied to earth based lunar photography is discussed. A computer produced, color difference photograph is shown. Author

N69-40812*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE EFFECT OF OBJECT MOTION IN FRAUNHOFER HOLOGRAPHY WITH APPLICATION TO VELOCITY MEASUREMENTS
William P. Dotson, Jr. Washington Nov. 1969 23 p refs
(NASA-TN-D-5515) Avail: CFSTI CSCL 14E

The in-line Fraunhofer hologram is analyzed with the assumption that the object moves a significant distance during the observation tiem. An equation is derived which predicts the effect that object motion has upon the recorded fringe pattern. An analysis of the fringe pattern recorded on the film consequently yields the total motion of the object during the observation time. It is also possible to reconstruct the resultant hologram so that the path the object traveled during the exposure time is reproduced. This knowledge, coupled with the exposure time, yields the desired measurement of the object velocity. Author

N69-40836# Royal Armament Research and Development Establishment, Fort Halstead (England).
THE R.A.R.D.E. PORTABLE VISIBILITY RECORDER
B. Bestley, G. H. Crockett, and E. Parry May 1969 18 p refs
(AD-691588; RARDE-Memo-17/69) Avail: CFSTI CSCL 14/2

This memorandum describes portable equipment developed to record variations in visibility when conducting field trials of night vision aids. The variation in the atmospheric transmission is measured by recording the apparent brightness of an incandescent filament lamp viewed over ranges which may be varied to suit the particular trial. The equipment has been used successfully out to a maximum range of 1000 metres. Author (TAB)

N69-40867# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
CONSTRUCTION, CALIBRATION, AND OPERATION OF A VIBRATING-SAMPLE MAGNETOMETER
Albert E. Miller Jan. 1969 72 p refs
(Contract W-7405-eng-82)
(IS-1717; TID-4500) Avail: CFSTI

A vibrating-sample magnetometer of the Foner type, capable of measuring magnetic moments in the 200 emu to 10^{-4} emu range from 4.2 to 300K, was constructed. The details of the construction are discussed and many figures are included that illustrate the electronic and mechanical systems used. Three different techniques used to calibrate the instrument, are discussed and compared. The general operating procedures employed in the use of the instrument are also presented. Author (NSA)

N69-40934# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
RECIPROCAL MULTIPLICATION METER
Warren R. Sheets 9 Jun. 1969 8 p
(Contract AT(29-1)-1106)
(RFP-925) Avail: CFSTI

A reciprocal multiplication (1/M) meter has been developed and successfully tested at the Rocky Flats Plant, Nuclear Safety Laboratory. The instrument presents continuous readings of reciprocal multiplication while an experiment is in progress. Normally the reciprocal multiplication is obtained by taking counts of the neutron-leakage field intermittently during a test. Use of the instrument provides a continuous account of reciprocal multiplication, while reactivity is being added. Author (NSA)

N69-40968# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ADJUSTABLE SLIT ASSEMBLY
J. J. Stoffels Jun. 1969 5 p ref
(Contract AT(45-1)1830)
Avail: CFSTI

A slit assembly providing independently adjustable slit-width and position is described. Adjustment is made by bellows seals and commercial micrometer heads. The entire assembly is mounted on a 2-3/4 in. OD high-vacuum flange, with stainless steel being the only material exposed to vacuum. The design is applicable to any type of spectrometer requiring beam definition. Complete blueprints are included. Author (NSA)

N69-40989# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.
BERYLLIUM: A REAPPRAISAL OF ITS USE IN NUCLEAR RADIATION DETECTORS
J. H. Howes and J. W. Leake Apr. 1969 10 p refs
(AERE-M-2193) Avail: HMSO 2s 6d

The use of beryllium for the construction of nuclear radiation detector bodies and as a vacuum tight envelope is reappraised in the light of present-day beryllium technology. Applications for neutron sensitive ionization chambers and proportional counters are considered and some preliminary results are given on low energy x rays using a gas-filled proportional counter with a body made wholly from beryllium, with a cylindrical wall thickness of 250 μm. Author (NSA)

N69-41084# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
INSTRUMENTS IN THE FIELD: USE, ABUSE, AND MISUSE
R. L. Kathren Dec. 1968 11 p refs Presented at the Midyear Symp. on Operational Monitoring, Los Angeles, Calif., 29 -31 Jan. 1969
(Contract AT(45-1)-1830)
(BNWL-SA-2150; CONF-690103-16) Avail: CFSTI

Advances in field instrumentation have been great over the past decade, providing the operational health physicist with a powerful armamentarium. However, even the most modern instruments have many limitations, and measurements must be made and evaluated in the light of these limitations, which include energy and angular dependence, response to pulsed sources, and effects of mixed radiation fields. The concept of surface dose rate, its meaning, use, and misuse, is examined in the context of operational health physics, and a practical method of measuring doses close to the source-air interface is discussed. Author (NSA)

N69-41116# Hulburt (E. O.) Center for Space Research, Washington, D.C. Space Science Div.
RADIATION SOURCES FOR STELLAR TELESCOPE CALIBRATION FROM 700 ANGSTROMS TO 7000 ANGSTROMS
W. R. Hunter *In* NRL Report of NRL Progress Sep. 1969 p 1-9 refs Presented at the Workshop on Opt. Telescope Technol., MSFC, Alabama, 29 Apr.-1 May 1969 (See N69-41115 24-34)
Avail: CFSTI

Radiation sources for calibrating stellar telescopes to be operated in space have been investigated in the wavelength region 700 to 7000 angstroms. A number of such sources are available. Because of difficulties in standardization, however, most of the sources require frequent calibration against a known source. Author

N69-41127# Air Force Cambridge Research Labs., Bedford, Mass.
TOTAL FIELD INTENSITY MAGNETOMETER
Peter Prevett (Weston Obs., Weston, Mass.), and Fernando de Mendonca (Sao Jose Dos Campos, Sao Paulo, Brazil) *In its* Geophys. and Space Data Bull., vol. 6, no. 1, 1969 p 3-12 (See N69-41126 24-13)
Avail: CFSTI

Measured data from total field intensity magnetometers located at Weston Observatory, Massachusetts and Sao Paulo, Brazil are presented. The Weston Observatory data consist of hourly mean, daily average, activity index, and range values. The Sao Paulo data reflect hourly mean values, as well as those for daily mean, index and range, hourly mean per month, and monthly mean. A.C.R.

N69-41130# Air Force Cambridge Research Labs., Bedford, Mass.
RIOMETER
Raymond J. Cormier *In its* Geophys. and Space Data Bull., vol. 6, no. 1, 1969 p-59-83 refs (See N69-41126 24-13)
Avail: CFSTI

Studies involving continuous riometer recordings which yield data on normal, as well as anomalous, ionospheric absorption are briefly described. From the data it is possible to determine electron density profiles, distribution of absorption due to bombarding solar particles and electromagnetic waves, nature of ionizing processes in the lower ionosphere, and the intensity and occurrence of solar noise bursts. Short descriptions of the equipment used and the method of data reduction are also included. A.C.R.

N69-41138# Scientific Translation Service, Ann Arbor, Mich.
NEUTRON PROBE FOR CONNECTION TO THE VA-J-05 RADIOMETER FOR RADIATION PROTECTION MEASUREMENTS
J. Steuer and W. Kiesewetter Dec. 1968 13 p refs Transl. into ENGLISH from German Report (Berlin). Dec. 1968 20 p Sponsored by AEC Prepared for Oak Ridge Natl. Lab.
(ORNL-tr-2150) Avail: CFSTI

Design and characteristics of an instrument for the measurement of neutron dose-equivalent rate in radiological protection are described. The instrument is provided by combining an Andersson-Braun type moderator assembly with a commercially available beta-gamma radiometer. A corona proportional counter with a boron layer on the cathode is used as detecting instrument for thermal neutrons. The gamma to neutron sensitivity ratio is at least 1:2000 at gamma levels up to 50 R/h. Author (NSA)

N69-41184*# Virginia Polytechnic Inst., Blacksburg. Dept. of Physics.
GAS DENSITY DETECTOR FOR USE IN SPACE
D. S. Wollan, W. P. Trower, K. Ramamurti, and W. K. Meshejian Oct. 1969 62 p refs Submitted for publication
(Contract NAS1-8145)
(NASA-CR-66834) Avail: CFSTI CSCL 14B

The suitability of radioactively-induced currents in ionization chambers and proportional counters and of breakdown currents in glow tubes as a monitor of gas density for meteoroid detection in space was investigated. Ionization chambers using moderate alpha sources have maximum currents $\leq 10^{-6}$ A at several hundred volts. The current has an approximate linear dependence on gas density at intermediate densities, which might make it useful as a hole size detector. Proportional counters utilizing similar sources provide currents up to 10^{-4} A at $\approx$ 1000 V, but the dependence of current on gas density is nonmonotonic, which would make analysis of their readings difficult. The most promising gas detectors are glow tubes, which have currents $\approx$ 1 mA at moderate voltages. Optimum parameters for a coaxial glow tube are given, using helium gas and a 0.34-μ Ci cobalt 60 radioactive foil source to aid in firing each tube. Three devices were constructed and calibrated from -195° to 100° C. Vibration tests are reported. Use of a glow tube for meteoroid hole size detection in space may be difficult. Author

N69-41212*# Perkin-Elmer Corp., Pomona, Calif. Aerospace Systems.
TEKTITE 1: TWO GAS ATMOSPHERE SENSOR SYSTEM DEVELOPMENT Final Report
1969 75 p
Contract NAS1-8631)
(NASA-CR-66835) Avail: CFSTI CSCL 14B

Installation and performance in an undersea environment of two gas atmosphere sensory system are discussed. This mass spectrometer system provides four simultaneous and linear output voltages that are proportional to the partial pressures of oxygen, carbon dioxide, water vapor, and nitrogen. Modifications for Tektite operations were mainly carried out in the sample inlet system. A self-contained ion pump and pump power supply, monitor and control functions, a calibration system, and pressure housing for the mass spectrometer were added. The two gas atmosphere sensor system accurately monitored the high pressure atmosphere of the Tektite habitat and provided useful data for atmosphere control applications. An operations and performance test data for the Tektite atmosphere analyzer system are also presented. E.C.

N69-41232# California Univ., Berkeley. Lawrence Radiation Lab.
PHASE DETECTOR
H. P. Robinson Jun. 1969 3 p
(Contract W-7405-eng-48)
(UCRL-18926) Avail: CFSTI

A simple phase detector is described which can be used to compare the relative phase of a signal and a train of pulses, the two not necessarily having the same repetition period. Author (NSA)

N69-41268# California State Div. of Highways, Sacramento. Materials and Research Dept.
A FIELD EVALUATION OF COMPACTION CONTROL WITH NUCLEAR GAGES Final Report
Travis Smith, W. G. Weber, D. R. Howe, R. E. Smith, and C. T. Gipson Aug. 1968 25 p refs Prepared in cooperation with Bur. of Public Roads
(PB-183666; M/R-632697-6) Avail: CFSTI CSCL 14B

The experience gained in the use of portable nuclear gages in compaction control on eleven projects at various locations is reported. Both backscatter and transmission type gages of various manufacture were employed. The general experience with safety, gage breakdowns, gage design, and test method is discussed. Author (USGRDR)

N69-41269# Los Alamos Scientific Lab., N.Mex.
DESIGN AND OPERATION OF THE LOS ALAMOS AUTOMATIC COMPARATOR FOR MEASUREMENT OF SPECTRA
David W. Steinhaus, Rolf Engleman, Jr., and Kay J. Fisher Dec. 1968 67 p refs
(Contract W-7405-eng-36)
(LA-4117) Avail: CFSTI

This automatic comparator uses a digital computer to do the complete job of finding and measuring each spectral line in an absorption or emission spectrum. The spectral information is transcribed into a list of readings taken at small equal intervals along the spectrum. These readings are transmission values from spectrum plates, or intensity values recorded directly from a scanning spectrometer. The computer output consists of the positron, wave number, log intensity, and shape of each line found. The results are similar to those obtained by a skilled operator using a photoelectric comparator, but are more consistent and obtained much more rapidly. This report supersedes LA-3100 which originally described the automatic comparator. Changes to both the apparatus and the computer program improve reliability and reduce the number of errors. Author (NSA)

N69-41298# California Univ., Livermore. Lawrence Radiation Lab.
IMPROVING AVAILABILITY AND READINESS OF FIELD EQUIPMENT THROUGH PERIODIC INSPECTION
Benjamin Epstein and Albert Schiff 16 Jul. 1968 14 p refs
(Contract W-7405-eng-48)
(UCRL-50451) Avail: CFSTI

In improving availability and readiness of field equipment, field operation of equipment is viewed as a continuing process with periodic checks and calibrations to discover failed items which are restored to operation. Expressions are derived to determine long-run availability or readiness of items of equipment and the number of units which must be in the field in order that a minimum number of items are available at anytime. The expressions which are derived are independent of the number of systems in operation. NSA

N69-41304# IIT Research Inst., Chicago, Ill.
CONTINUOUS FACSIMILE SCANNER EMPLOYING FIBER OPTICS Final Report, 24 Jun. 1964 - 31 Jul. 1969
D. A. Pontarelli, R. Schwab, and K. Norikane Fort Monmouth, N.J. ECOM Jul. 1969 58 p
(Contract DA-28-043-AMC-00164(E))
(AD-691753; IITRI-V6015-55; ECOM-00164-F; Rept-55) Avail: CFSTI CSCL 17/2

Fiber optics was successfully employed to perform the functions of image dissection and scanning in Facsimile Transmission. Two operational models were developed and constructed to incorporate the concept. One was designed to scan copy 8 1/2-inches wide, the other, 18 5/8-inches wide. Both instruments posses the unique capability of continuously scanning copy of any length. Author (TAB)

N69-41340# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Kernphysik.
TWO-PARAMETER GAMMA-GAMMA COINCIDENCE ANALYSIS WITH A Ge(Li)-Na I(Tl) SPECTROMETER AT THE KARLSRUHE FR-2 REACTOR
U. Fanger Jan. 1969 13 p refs In GERMAN
(KFK-887) Avail: AEC Depository Libraries

The coincidence combination of Ge(Li) diodes with NaI(Tl) detectors represents an efficient spectrometer especially in the γ energy range from 100 keV to 3 MeV. The coupling of the apparatus to the Karlsruhe computer system MIDAS makes possible two-parameter measurements with full channel resolution. The advantages resulting lie in the simultaneous detection of several coincidences and in the optimum positioning of the coincidence window in spectra with good counting statistics at the end of a measurement. Author (NSA)

N69-41382# Sandia Corp., Albuquerque, N.Mex.
MEASUREMENT OF THERMISTOR MOUNT CALIBRATION FACTOR BY A COMPARISON METHOD
James C. Drake and Robert D. Moyer Dec. 1968 13 p
(PB-183839) Avail: CFSTI CSCL 14B

The report describes a method for calibrating temperature-compensated thermistor mounts which is accurate, fast, and repeatable. The report includes an error analysis, a description of the equipment, and a brief explanation of its use. Author (USGRDR)

N69-41395 National Lending Library for Science and Technology, Boston Spa (England).
THE CHARACTERISTICS OF PICTURE QUALITY OF PHOTOGRAPHS
Rudolf Reuther et al. 1 May 1969 22 p refs Transl. into ENGLISH from Z. Wiss. Phot. Photophysik. Photochem. (Leipzig), v. 61, no. 7/9, 1967 p 125-144
(NLL-T-6267-(5809.95)) Avail: Natl. Lending Library, Boston Spa, Engl. 2 NLL photocopy coupons

A psychometric evaluation was made of picture quality using approximately 20 to 25 observers. Two negatives were used with different subject material. Gradient criteria were investigated using architectural photographs. Comparisons were made of the pictures and observers opinions. Using this information and standarization of the 100 best and 10 worst films, numerical values were obtained for picture and border definition. Two methods are given for obtaining picture definition by physical criteria: the modulation transfer function method and the boundary curve method. The modulation transfer method seems to be the preferable method. E.H.W.

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N69-40011# Sandia Corp., Albuquerque, N. Mex.
ROLAMITE: A NEW MECHANISTICAL DESIGN CONCEPT
D. F. Wilkes Mar. 1969 258 p refs Sponsored by AEC Supercedes SC-RR-67-656A
(SC-RR-67-656-B; SC-RR-67-656A) Avail: CFSTI

The rolamite geometry, recently developed by Sandia Laboratory, forms an extremely tolerant precision rolling suspension suitable for a wide range of applications and does not require precision tolerance machining to manufacture. Rolamite exhibits coefficients of friction 1 to 10 percent of the values obtained from conventional bearings; no lubrication is required. Rolamite geometry produces axial forces of any desired character. It can provide nearly all the mechanical functions normally discussed in mechanical engineering machine design text books as well as many electromechanical functions. The simplicity of the rolamite geometry enables the design of innumerable complete electromechanical devices composed of only 4 to 10 piece-parts. Sandia Laboratory is developing a modular design suitable for producing a wide range of microminiature weapon components in which one key part provides from 80 to 95 percent of the necessary functions. Author (NSA)

N69-40247# Arizona Univ., Tucscon. Engineering Experiment Station.
NEW TECHNIQUES IN NONDESTRUCTION TESTING BY ACOUSTICAL AND EXO-ELECTRON EMISSION Semiannual Progress Report, 1 Jul. 1968 - 28 Feb. 1969
Robert H. Chambers and Stuart A. Hoenig 28 Feb. 1969 12 p refs
(Contract F33615-68-C-1707; ARPA Order 1244)
(AD-691230) Avail: CFSTI CSCL 14/2

The report discusses progress in the identification and classification of the acoustical and exo-electron emission characteristics of deformed materials. TAB

N69-40290# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INFLUENCE OF TEMPERATURE CONDITIONS OF A WORKING FLUID ON THE FRICTION OF HYDRAULIC CYLINDER PACKINGS
V. N. Borisov et al. 10 Jun. 1969 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), No. 4, 1968 p 88-92
(AD-692146; FTD-MT-24-121-69) Avail: CFSTI CSCL 11/1

The article examines the friction process of packings of hydraulic power cylinders at a temperature of the contact surfaces of from -40 to & 100 C with lubrication provided by different mineral oils. Oscillograms of the frictional force of common types of sealing devices were obtained and the most favorable range of temperatures of the working fluid of hydraulic machines and mechanisms was determined. Author (TAB)

N69-40312# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INCREASE IN STRUCTURAL STRENGTH OF WELDED JOINTS DUE TO PRELIMINARY REINFORCEMENT OF THE WELDED EDGES

V. M. Nikitin et al. 17 Jun. 1969 13 p refs Transl. into ENGLISH from Tr. Inst. Neftekhimicheskoy i Gazovoy Prom. (Moscow), no. 70, 1967 p 137-141

(AD-692052; FTD-MT-24-89-69) Avail: CFSTI CSCL 13/5

The article briefly discusses strengthening of welded joints by preliminary reinforcement (thickening) of the weld area. A method developed by the Moscow Aviation Technical Institute is described. Results of reinforcement were tested to determine strength of the welded joint. TAB

N69-40381# Dayton Univ. Research Inst., Ohio.

EFFECT OF OXIDE FILM ON THE FRICTION OF 52100 STEEL IN VACUUM

Riitsu Takagi Apr. 1969 38 p refs

(Contract F33615-69-C-1385)

(AD-690618; AFML-TR-69-88) Avail: CFSTI CSCL 11/6

To solve the problem of sudden drop of friction coefficient in reciprocated slidings of 52100 bearing steel in ultrahigh vacuum, friction studies were made of a 52100 test steel ball sliding on a 52100 steel flat reciprocally with a 9.5 mm long stroke at an average speed of 2 mm/sec under 500 to 1000 g loads in vacuum. In ultrahigh vacuum sliding, the friction coefficients starts from 0.2 - 0.5, increases to a maximum 1.0 - 1.2 and drops to 0.5 - 0.6 at 20-100 traverses. After the drop no basic change of friction coefficients takes place other than a very gradual increase. Both friction force-time curves and the sliding areas change from smooth to rough when the friction undergoes the drop. The maxima and following drop of the friction coefficient vs. number of traverses plots are ascribed to build-up and rupture of oxide film that forms on the surface of the 52100 steel specimen in atmosphere. The friction is affected by applied load, finish mark direction on the relative to sliding and air pressure in the test chamber. Author (TAB)

N69-40388# Army Foreign Science and Technology Center, Washington, D.C.

HYDRAULIC TRANSMISSION

V. K. Shlykov et al. 24 Jun. 1969 7 p Transl. into ENGLISH from Byull. Izobret. Tovarnykh Znakov (Moscow), no. 5, 1968 p 45-46

(AD-691311; FSTC-HT-23-384-69) Avail: CFSTI CSCL 13/6

A hydraulic transmission is strengthened and reduced in size, the last stage of the control apparatus in the starting hydroconverter is supported by a shaft running through the hollow turbine shaft of the reverse reducing gear. Author (TAB)

N69-40406# Dartmouth Coll., Hanover, N.H.

THE DESIGN OF AN ENDPOINT CONTROL SYSTEM FOR THE BASIC OXYGEN STEEL FURNACE

Richard J. Kornblum Jun. 1968 169 p

(Contract F44620-68-C-0015)

(AD-691859; AFOSR-68-2201-TR) Avail: CFSTI CSCL 13/8

A digital simulation of the Basic Oxygen Steel Furnace was achieved and shown to reproduce the available data taken from the literature within 10%. Using the simulation as an off-line model of the process, an endpoint control system has been designed. A sub-optimal and an optimal endpoint control system were designed. Both systems make use of the available feedback from the process, which consists of previously existing instrumentation for effluent gas analysis and an instrument concurrently and independently designed for quick carbon analysis. Author (TAB)

N69-40461# Techtran Corp., Glen Burnie, Md.

THE PROBLEM OF TURNING IN MULTITRACK VEHICLES

A. G. Mayevskii et al. 27 Jun. 1969 16 p refs Transl. into ENGLISH from Cornyve, Stroit. i Dor. Maschiny (Sbornik), 1965 p 85-99 Sponsored by Army Foreign Sci. and Technol. Center.

(AD-691552; FSTC-HT-23-385-69) Avail: CFSTI CSCL 13/3

A theoretical and numerical analysis of forces acting on three-track vehicles in two configurations, symmetrical with respect to a longitudinal axis and symmetrical with respect to a transverse axis. Simplified to equal power applied at all three tracks. Author (TAB)

N69-40468# Commissariat à l'Energie Atomique, Bruyères-le-Chatel (France).

STUDY METHODS FOR THE DRILLINGS AROUND THE UNDERGROUND NUCLEAR EXPLOSIONS IN THE SAHARA. PART 1: STUDY OF ROCK SAMPLES [METHODES D'ETUDES DES FORAGES REALISES AUTOUR DES EXPLOSIONS NUCLEAIRES SOUTERRAINES AU SAHARA. PREMIERE PARTIE: ETUDE DES ECHANTILLONS DE ROCHE]

Serge Derlich Aug. 1969 21 p refs In FRENCH; ENGLISH summary

(CEA-R-3762-1) Avail: CFSTI

An examination of the mechanical effects produced on rocks by an underground nuclear explosion calls for the use of particular means of exploration which are described in this report, special attention being paid to the equipment used in connection with the French nuclear tests in the Sahara. The drilling methods used (rotary and turbodrilling) are adapted to the particular conditions of the sampling programme, to the radioactivity and to the temperature in the region of the explosion. A study of the samples makes it possible to obtain the new characteristics of the rock and to assess the chemical and mechanical transformations which they have undergone. An examination of the core obtained from the drilling, together with a knowledge of the drilling parameters (depth of the probe, sample recovery, etc...), makes it possible to study the extent and the characteristics of the zones which have been damaged to different degrees according to their distance from the zero point: cavity, strongly powdered zone, fractured zone, chimney, zones containing high stresses leading to a particular type of fracture of the cores. The problems connected with the interpretation of the results are also presented. Author (ESRO)

N69-40472# Laboratoire de Recherches Balistiques et Aérodynamiques, Vernon (France).

ACCEPTANCE TEST REPORT OF METREL GV 500 VIBRATION TEST MACHINECOMPTE RENDU DE RECEPTION DU POT VIBRANT METREL GV 500]

27 May 1969 85 p refs In FRENCH

(LRBA-E-110-NT-4/SEV/SI) Avail: CFSTI

Acceptance procedures and results are given for tests carried out on the Metrel GV 500 vibration test machine. ESRC

N69-40552# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.

ANALYSIS AND SIMULATION OF DYNAMICAL VEHICLE-TERRAIN INTERACTION

D. Schuring and M. R Belsdorf May 1969 209 p refs

(Contract DAHC04-67-C-0005; ARPA Order 841)

(AD-690841; CAL-VJ-2330-G-56) Avail: CFSTI CSCL 13/6

The reported study is part of a broad research program designed to acquire off-road mobility knowledge; develop analysis prediction, and decision methodologies; and organize knowledge and methods to facilitate use by military planners, vehicle designers and field personnel concerned with off-road mobility. This particular study was concerned with the development of generalized vehicle-terrain mathematical models of wheeled and tracked vehicle running in hard and soft soil. The computer simulation phase of work was carried to the point of mechanizing 3-degree-of-freedom and 5-degree-of-freedom models in real time on the analog computer. Author (TAB)

N69-40584# Royal Aircraft Establishment, Farnborough (England).

THE INSPECTION OF PRECISION CONICAL SURFACES FOR GAS BEARINGS

D. Faddy and T. L. Ellis Oct. 1968 16 p ref

(RAE-TR-68261) Avail: CFSTI

This report describes a procedure for inspecting the surfaces of small self-pressurised conical gas bearings. The method can be adapted for other high precision conical parts having either male or female surfaces. Author (ESRO)

N69-40837# Army Foreign Science and Technology Center, Washington, D.C.
AIRDROP CONTAINERS
A. I. Privalov et al. 25 Jun. 1969 8 p Transl. into ENGLISH of Russian Patent No. 184152, 8 Sep. 1966
(AD-691553; FSTC-HT-23-393-69) Avail: CFSTI CSCL 13/4

A container for airdropping cargo, consisting of a cylindrical housing with a reinforced bottom and detachable lid, with a chamber for a parachute inside a portable case for packing the cargo and stabilizing the parachute, which is attached to the lid of the container, is described. Author (TAB)

N69-40840# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Electrotechnik.
ON THE CALCULATION OF FORCES AND DISPLACEMENTS IN FRICTION BEARINGS OF CRANKSHAFTS WITH VARIABLE STATIC SUPPORTS [BEITRAG ZUR BERECHNUNG DER KRAEFTE UND VERLAGERUNGEN IN DEN GLEITLAGERN STATISCH UNBESTIMMT GELAGERTER KURBELWELLEN]
Eglof von Schnurbein (Ph. D. Thesis) 1969 93 p refs In GERMAN
Avail: CFSTI

An improved calculation method is used which considers the crankshaft as a statically indeterminate axis supported by friction bearings. The interrelation between main bearing forces and the journal displacements is established by an iteration process taking into account the effects of variations in the dimensions of the bearings, clearances, and oil viscosity in the motor. Errors in bearing alignment can also be analyzed with this method. The calculations were programmed in FORTRAN 4. Measurements and calculations were performed to determine the axial displacement of two main bearings of a 16-cylinder V-motor. A comparison of calculated results with measurements of the vertical component of the main bearing forces on two six-cylinder engines shows a marked improvement in accuracy of this method over those used heretofore. Transl. by K.W.

N69-41125# Harvey Engineering Labs. for Research and Development, Torrance, Calif.
DEVELOPMENT OF ELECTRON BEAM WELDING TECHNIQUE(S) Final Report
George B. Kortz Feb 1969 44 p
(Contract N00156-67-C-1608)
(AD-691845; HA-2437) Avail: CFSTI CSCL 1/5

Techniques were developed for the electron beam welding of end connectors to AM-2 type airfield landing mat extrusions. A portion of a production quantity of AM-2 and a lightweight version of AM-2 was field tested to verify the developed techniques. Program objectives were successfully accomplished, thus demonstrating that the electron beam process will produce joints structurally superior to those produced by the MIG and TIG welding processes. The service life of the joint substantially exceeds that of the mat extrusion. Author (TAB)

N69-41158# Du Pont de Nemours (E. I.) and Co., Wilmington, Del. Engineering Dept.
ULTRA PRECISION MACHINE TOOL ELEMENTS AND MACHINING PROCESSES
T. G. Lewis Oak Ridge, Tenn. Union Carbide Corp. 17 Oct. 1968 190 p refs Prepared for Union Carbide Corp., Oak Ridge, Tenn.
(Contract W-7405-eng-26)
(Y-1611) Avail: CFSTI

Engineering principles, as they apply to ultraprecise machining processes, were investigated as a part of a continuing program in the study of machine tools. In this machining process, maximum deviation from an idealized shape and size was not to exceed a few micropinches. Phases of the study reported include development of an experimental research machine that would be limited to turning solid hemispheres, but would deviate no more than 25 microinches from a four-inch diameter at any point on the hemisphere, and studies on the effects of material hardness and associated parameters on the machine tool elements and processes. Multistage operations are applied to machining a sphere with a deviation not to exceed five microinches, and a new and more versatile experimental machine that would be able to fabricate more delicate and complex test pieces is investigated. A new experimental machine tool called the hemishell turning machine which represents the epitome in ultraprecision machining technology was developed. Author (NSA)

N69-41181# Naval Civil Engineering Lab., Port Hueneme, Calif.
THE EFFECT OF COATINGS AND SURFACES ON DROPWISE CONDENSATION
S. C. Garg Jul. 1969 49 p refs
(AD-691394; TN-N-1041) Avail: CFSTI CSCL 13/1

A literature survey of the published information on the effect of coatings and surfaces on dropwise condensation was carried out. The survey revealed that research to date in promoting dropwise condensation has been limited mostly to small scale laboratory experiments. There appears to be a serious lack of data on methods of application of various dropwise promoters, useful life of promoters, effective concentration, and frequency of promoter renewal. This lack of information is highlighted by the total absence of dropwise condensation as a factor in design of condensers in industry. Recommendations are made to initiate an experimental program to evaluate the effects of vibrating the condenser surface upon dropwise condensation and the coefficients of heat transfer. Author (TAB)

N69-41210*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPEED EFFECTS ON BALL SPINNING TORQUE
Dennis P. Townsend, Marshall W. Dietrich, and Erwin V. Zaretsky Washington Nov. 1969 18 p refs
(NASA-TN-D-5527) Avail: CFSTI CSCL 13H

Tests were conducted in the NASA spinning friction apparatus to determine the effect of ball spinning speed on torque and coefficient of spinning friction. Reasonably good agreement was obtained between experimental torque values and theoretical torque predictions using an elastohydrodynamic analysis with a modified pressure-viscosity relation. Spinning torque increased with spinning speed, but the rate of increase was less than predicted from theory. This difference in the rate of increase in torque with speed was attributed to shearing of the lubricant which reduced the lubricant viscosity in the contact ellipse. No correlation was found between experimental and theoretical coefficients of spinning friction using a dry contact friction model. Author

N69-41256# California Univ., Livermore. Lawrence Radiation Lab.
APPARATUS FOR PRODUCING MACHINABILITY TEST SPECIMENS FOR STUDIES OF HIGH SPEED CHIP FORMATION ON AN ENGINE LATHE
Carroll Gordon 15 Aug. 1968 15 p
(UCRL-50479) Avail: CFSTI

LRL mechanical shops department has developed a safe and effective method for preparing metallurgical test specimens for the study of chip formations on metals, using single-point tools. This equipment, using a drop-hammer technique, drives the cutting tool from the workpiece, leaving the nascent chip attached to the parent metal. This chip is then segmented out of the test piece and processed metallographically. Photographic studies of the tool removal process show that the cutting tool is removed from a 300-ft per min. cut in approximately 1 μsec. Author (NSA)

N69-41293# National Tillage Machinery Lab., Auburn, Ala.
ASPECTS OF THE ENERGY EXPENDITURE REQUIRED TO ROLL DRIVEN WHEELS WITH PNEUMATIC TIRES ON SOIL
V. L. Strokov 4 Mar. 1969 4 p Transl. into ENGLISH from Moskovskaya Selskokhozyaistvennaya Akad., Dokl. (USSR) no. 96, 1964 p 53–56
(PB-183825T) Avail: CFSTI CSCL 13F

The expenditure of work to roll driven wheels with pnuematic tires on soil is made up of two parts: the work expended for deformation of the tire and that to deform the soil. The first part depends on the magnitude of the radial deformation of the tire, the material and its design parameters, the second part in addition to this depends on the structure and mechanical properties of the soil. During a change of the inflation pressure there is correspondingly a change in the expenditure of work. Consequently, the energy expended to deform the tire and soil must be expressed functionally in relation to the inflation pressure. This relationship graphically is presented by monotonically increasing curves. Author (USGRDR)

N69-41338# Extended Surface Tube Co., Ltd., England.
TUBE DEVELOPMENT FOR NUCLEAR PLANT
D. K. A. Hockly 1968 19 p Held at the BNX/BNF Nucl. Power Meeting, Copenhagen, Denmark
(CONF-680625-5) Avail: AEC Depository Libraries

Manufacturing techniques developed for the production of integral and welded fin tubes are described in detail. The integral fins are produced by a rolling process which radially extrudes the fin from a high-quality thick-walled plain tube. The welded fin tube is made by spirally winding and welding a strip on to a tube by methods which give a clean, strong weld at least as wide as the strip thickness without damaging the tube wall. Each type is evaluated and the testing, inspection, and quality control described. Developments in the use of finned tubing for steam/steam reheaters are discussed. Author (NSA)

N69-41389# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
STATISTICAL PARAMETRIC AND NON-PARAMETRIC METHODS TO DETERMINE THE DISTRIBUTION OF MECHANICAL COMPONENTS [METODI STATISTICI PARAMETRICI E NON PARAMETRICI PER LA STIMA DELL'AFFIDAMENTO DI COMPONENTI MECCANICI]
D. Basile and G. Voltra Jul. 1969 64 p refs In ITALIAN; ENGLISH summary
(EUR-4282-1) Avail: CFSTI

Various statistical methods were studied permitting determination of the distribution of the failure probability of a mechanical component using the experimental data obtained by tests on the component itself. Parametrical methods were considered (applying the maximum likelihood principle) and non-parametrical methods (order statistics); particular emphasis was also given to the use of probability papers. These methods for the Weibull distribution are applied to some samples concerning rup re resistance of intermetallic joints and the lifetime of mechanical components. Also presented are three digital computer programs (IBM 360/65) to determine the Weibull parameters, the ranks with a fixed confidence level and application of the Kolmogorov test. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N69-40109# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONCERNING REGENERATIVE AMPLIFICATION OF OPTICAL RADIATION
B. P. Kulakov et al 28 May 1969 14 p refs Transl. into ENGLISH from Tr. Univ. Druzhby Nar. (Moscow), v. 23, no. 3, 1967 p 149–155
(AD-692151; FTD-MT-24-128-69) Avail: CFSTI CSCL 20/5

The work is devoted to a theoretical consideration of parameters of a regenerative amplification laser with periodically variable optical length of the resonator and a method of regulating its amplification of one passage, based on the use of the electro-optical effect. Author (TAB)

N69-40159# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW PHYSICAL EFFECTS
G. Askaryan 2 Jun. 1969 14 p Transl. into ENGLISH from Nauka i Zhizn' (Moscow), no. 10, 1967 p 101–105
(AD-692051; FTD-MT-24-126-69) Avail: CFSTI CSCL 20/6

A semipopular discussion is given of new physical effects, the discovery of which was induced by the appearance of lasers. The majority of these effects pertain to the area of so-called nonlinear optics – optics of media, the properties of which can change under action of the field of radiation it self. Such changes become noticeable only at large intensities of radiation. At small intensities the properties of media change insignificantly and processes occurring in them obey the laws of conventional linear optics. Author (TAB)

N69-40163# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RECORDING STRESS WAVES INDUCED BY A LASER BEAM
A. Ye. Kuznetsov et al 26 May 1969 10 p refs Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (USSR), no. 3, 1968 p 3–6
(AD-691872; FTD-MT-24-120-69) Avail: CFSTI CSCL 20/5

Piezoelectric transducers were used to investigate the effect on a metal of free-running laser pulses with energies of from 10–15 joules. The cadmium-samples had a diameter of 10 mm and a height of 3 mm. The laser beam was focused in the center of the target using a lens with a focal length of 250 mm. An individual burst of radiation of short duration (approximately 1 microsecond) brings about a pressure pulse in the target. This pressure pulse causes an electric voltage pulse, in the electrodes of the transducer, which is recorded in an oscillograph. Analysis of the propagation of the stress waves in the piezoelectric transducer and of the formation of the charge permits an approximate calculation of the shape of the initial pressure pulse in the target. The experimental results show qualitative agreement with results obtained using the optical polarization method. TAB

N69-40645# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
INVERSION DEPENDENT FREQUENCY SHIFTS IN PASSIVELY Q-SWITCHED RUBY LASER AND SECOND HARMONIC EMISSION Final Report, 30 Sep. 1966–30 Sep. 1968
Alex L. Flamholz and George J. Wolga 31 Dec. 1968 184 p refs
(Contract AF 19(628)-5677)
(AD-691833; AFCRL-69-0111) Avail: CFSTI CSCL 20/5

Previous experiments have indicated an inversion dependent blue shift in the emission frequency of pulsed (non-Q-Switched) ruby lasers during the emission of a single pulse. The purpose of this work was to study the temporal coherence properties of single mode passively Q-Switched ruby laser emission by using a transient interference detection technique capable of better than 4 nsec resolution. The experiments were carried out using a Youngs double pinhole interferometer to interfere the output of the laser with a portion of the same output delayed by a given time period. From the time dependence of the interference pattern phase, in combination with the simultaneously measured time dependence of laser power it was firmly established that an inversion dependent blue shift exists in the emission frequency of a single mode Q-Switched ruby laser. A number of physical mechanisms are

discussed which could possibly account for a laser frequency shift. Experiments were also performed to determine the direction and magnitude of any existing frequency shifts in second harmonic emission (at 3472 A). Author (TAB)

N69-40890 Maryland Univ., College Park.
MEASUREMENTS OF TEMPORAL CORRELATIONS IN THE ELECTROMAGNETIC FIELD RADIATED BY A LASER IN THE THRESHOLD REGION OF OSCILLATION
Ren-Fang Chang (Ph.D. Thesis) 1968 219 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 69-2221

The intensity fluctuations in laser radiation in the threshold region of oscillation, which spans from 1/10 of threshold intensity to ten times threshold intensity were studied. All experimental results were compared with theoretical predictions based on solutions of a Fokker Planck equation. The statistics of the photoelectron distributions show that the intensity fluctuations at about one-tenth threshold are nearly those of a Gaussian field, and the IPDF approaches continuously the form appropriate to nearly constant amplitude when the intensity is brought up to about 10 times threshold. The transition in statistics from Gaussian at below threshold to constant amplitude above threshold is very well demonstrated by the data, which also agree remarkably well with the theory based on the Fokker Planck equation. Dissert. Abstr.

N69-40981# TRW Systems Group, Redondo Beach, Calif. Quantum Physics Lab.
HIGH INTENSITY LASER PROPAGATION IN THE ATMOSPHERE Final Report
L. M. Frantz and T. D. Holstein 30 Jun. 1969 91 p ref 30 Jun. 1969 91 p ref
(Contract N00014-66-C-0022; ARPA Order 306; Proj. Defender)
(AD-691846; TRW-05691-6014-R000) Avail: CFSTI CSCL 20/6

The research reported here involves the thermal self-defocusing effect, which occurs in the case of high energy laser beam propagation in the atmosphere. Two subjects are investigated, namely, heating mechanisms, and the dynamics of the propagating laser beam. The heating mechanism study is concerned specifically with photo-absorption in the far wings of pressure broadened CO2 vibration-rotation bands, while the beam dynamics analysis treats the effects of target motion on the degree of self-defocusing of the laser beam. A theory of far-wing pressure broadening is developed in which the basic broadening mechanism is assumed to arise from perturbations of the absorbers rotational motion via a short range repulsive interaction with a colliding molecule. The theory predicts a far-wing spectral behavior described by a product of a Lorentz line shape and an exponentially decreasing factor, in general agreement with recent measurements. In the beam dynamics work a convenient closed form expression has been obtained for the maximum flux which the thermal self-defocusing effect permits one to transmit through the atmosphere. This analysis takes into account the effect of target motion. The expression for the maximum flux depends upon such parameters as the initial beam intensity, the initial beam diameter, the target distance, the rotational rate of the beam, and the effective absorption coefficient for heating of air by light at the laser frequency. Author (TAB)

N69-41038# Technische Hochschule Munchen (West Germany).
STUDIES OF THE NONLINEAR OPTICS OF STIMULATED BRILLOUIN SCATTERING AND INDUCED TRANSPARENCE IN THE WAVELENGTH RANGE AT 10 MU [UNTERSUCHUNGEN ZUR NICHTLINEAREN OPTIK STIMULIERTE BRILLOUIN-STREUUNG UND INDUZIERTE TRANSPARENZ IM WELLENLAENGENBEREICH BEI 10 MU]
Peter-Michael Asam (Ph.D. Thesis) 1969 129 p refs In GERMAN
Avail: CFSTI

Technological developments and physical properties of the carbon dioxide laser are discussed. Its experimental application to stimulate Brillouin scattering in germanium and to induce transparency in methanol are demonstrated. Transl. by G.G.

N69-41065 Connecticut Univ., Storrs.
LASER INDUCED PHOTOCURRENT IN CADMIUM SULFIDE
Gerald Carl Holst (Ph.D. Thesis) 1968 65 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-2147

Two-photon absorption is expected in CdS when it is excited by a ruby laser. The double photon absorption coefficient, cross section and photocurrent is derived from second-order, time dependent perturbation theory. A Q-switched ruby laser is used so that the electron-hole pair generation rate is much less than the recombination time. Thus the induced photocurrent is solely dependent upon the number of electron-pair generated. Excitons are not considered due to their charge neutrality; they therefore do not contribute to current flow. Theoretically, the induced photocurrent depends upon the square of the laser intensity. Observed variations in measured photocurrent are believed due to a copper impurity level in the band. Dissert. Abstr.

N69-41195# Idaho Nuclear Corp., Idaho Falls.
BIBLIOGRAPHY OF LASER PUBLICATIONS OF INTEREST TO EMISSION SPECTROSCOPISTS
Jon M. Baldwin Oct. 1968 19 p refs
(Contract AT(10-1)-1230)
(IN-1219) Avail: CFSTI

Two hundred and fifty-eight references covering the period to July 1, 1968 are presented in three sections: laser beam interactions with gases, laser beam interactions with condensed phases, and laser applications to spectrographic analysis. NSA

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N69-40017# General Electric Co., Cincinnati, Ohio.
A NEW APPROACH TO THE PREDICTION OF LOW CYCLE FATIGUE DATA
J. T. Berling and J. B. Conway May 1969 29 p refs Presented at the Aime Spring Meeting, Pittsburgh
(Contract AT(40-1)-2847)
(GEMP-697; CONF-690507-2) Avail: CFSTI

Low-cycle fatigue data for annealed AISI Type 304, 316, and 348 stainless steel to 816°C was analyzed and a new relationship was identified associating fatigue data with short-term tensile behavior. A logarithmic plot of plastic strain range versus time to fracture was shown to be linear with a slope of minus unity. This line was also found to originate at the point corresponding to the tensile ductility. A similar analysis for elastic strain range data revealed a relationship with the strain-hardening exponent measured in a short-term tensile test at the same temperature and strain rate. These correlations were combined to provide an equation for predicting the relation between total strain range and cycles to fracture. This approach has been termed the Method of Specific or Characteristic Slopes. Author (NSA)

N69-40019# Los Alamos Scientific Lab., N. Mex.
DUCTILITY STUDIES ON SINTERED TUNGSTEN MOLYBDENUM RHENIUM ALLOYS
W. H. Lenz and R. E. Riley 20 Feb. 1969 14 p refs
(Contract W-7405-eng-36)
(LA-4136) Avail: CFSTI

A Brinell brittleness test developed several years ago has undergone considerable experimentation with regard to optimum specimen diameter and thickness. A new, slightly larger, specimen

size was used for more sensitive ductility measurements of sintered tungsten-molybdenum-rhenium alloys with 0 to 8 at. % Re. A possible heat treatment for such alloys to restore ductility normally lost through grain growth appears evident. Author (NSA)

N69-40053*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SOLUBILITIES OF MOLYBDENUM AND TUNGSTEN IN LIQUID POTASSIUM

Stephan Stecura Washington Oct. 1969 14 p refs

(NASA-TN-D-5504) Avail: CFSTI CSCL 11F

A study was made of the solubilities of molybdenum and tungsten in liquid potassium containing less than 15 ppm by weight of oxygen. The solubility of molybdenum at 1040° and 1316°K is about 6 and 13 ppm by weight and that of tungsten at 1055° and 1328°K is about 20 and 130 ppm by weight, respectively. The apparent heats of solutions for molybdenum and tungsten solubilities in liquid potassium are 6.7 ±0.8 and 17.6 ±1.2 kcal/mole (28.0 and 73.7 kJ/mole), respectively. The solubility data for molybdenum are either the true solubility data, or relatively close to the true solubility data, for molybdenum in liquid potassium between 1040° and 1316°K. The solubility data for tungsten in liquid potassium between 1055° and 1328°K suggest that the solubility values might have been influenced by interstitial impurities, particularly by oxygen. Author

N69-40057*# Battelle Memorial Inst., Columbus, Ohio.

RESEARCH ON METALLURGICAL CHARACTERISTICS AND PERFORMANCE OF MATERIALS USED FOR SLIDING ELECTRICAL CONTACTS Summary Report, 1 May 1968 - 30 Apr. 1969

W. H. Abbott and E. S. Bartlett Washington NASA Oct. 1969 61 p refs

(Contract NAS12-657)

(NASA-CR-1447) Avail: CFSTI CSCL 11F

Studies of the friction, wear, and contact resistance stability of nine wrought gold alloys and three electroplated gold systems were made in both N_2-20 O_2 and high vacuum. Sliding durations were 100 cycles in N_2-20 O_2 and 500 cycles in vacuum. Environmental tests were made on each materials system. These consisted of exposure to flowers of sulfur at 30°C, and 1000-hour storage in N_2-20 O_2 at 200°C. Wear test and control specimens exposed in this manner were analyzed by contact resistance measurements and analysis of surface films. All of the wrought gold alloys showed high friction (μ_k = 1.2-2.0) and wear rates in both air and vacuum. No correlation was apparent between wear rates, wear mechanism, and mechanical properties. Differences in wear and friction were attributed almost entirely to differences in surface chemistry or surface energy of the alloy. Contact resistance stability was shown to be closely related to wear mechanism and resistivity. High resistivity and fine wear particles always produced static contact resistance instability and high noise levels. Author

N69-40071# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

INTERDIFFUSION BETWEEN CERTAIN VAPOR DEPOSITED-FOIL REFRACTORY METAL COUPLES

J. M. Steichen Jun. 1969 25 p refs

(Contract AT(45-1)-1830)

(BNWL-1071) Avail: CFSTI

A study was conducted to determine the extent of interdiffusion between refractory metal couples which had been partially or completely prepared by chemical vapor deposition. The couples which were tested included tungsten-iridium, tungsten-rhodium, rhenium-tungsten, and tantalum-tungsten. At the completion of the diffusion annealing, metallography, and electron microprobe scans it was concluded that the rhenium-tungsten couple was the most compatible of those tested. Author (NSA)

N69-40072# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

FATIGUE CRACK GROWTH AND PROPAGATION IN Zr-2.5 wt PERCENT Nb ALLOY PRESSURE TUBING

P. J. Pankaskie Jun. 1969 36 p refs

(Contract AT(45-1)-1830)

(BNWL-1076) Avail: CFSTI

Tubes of Zr-2.5 wt % Nb alloy were fatigued in the tension-tension mode by cyclic internal pressures to cause axial crack growth and unstable fractures at room temperature. Pressure cycle rates were 400 and 3000 cycles per hour. Both the cold worked and heat treated conditions, before and after hydriding were investigated. Exploratory tests were done to determine the effect of the axial length of the surface stress intensifying defect, and multiple surface stress intensifying defects on fatigue crack initiation, growth, and critical length at unstable fracture. From short length defects, fatigue crack initiation and growth will occur at nominal peak hoop stresses equal to or less than the estimated endurance limit. For fatigue cracks initiated at the outer diameter surface, the shape of the crack front is semicircular. The number of stress cycles required to initiate fatigue cracking at the surface is inversely proportional to the square of the surface defect length. Author (NSA)

N69-40123*# Case Western Reserve Univ., Cleveland, Ohio. Div. of Metallurgy and Material Science.

MODIFIED EUTECTIC ALLOYS FOR HIGH TEMPERATURE SERVICE Final Report, Jul. 1967 - Apr. 1969

M. U. Ordillas, Jr. and J. F. Wallace Apr. 1969 115 p refs

(Grant NGR-36-003-033)

(NASA-CR-106306) Avail: CFSTI CSCL 11F

Better congruently melting alloys were modified with a considerable number of additions to enhance oxidation resistance, provide solid solution strengthening, and produce discrete precipitates from the melt. Stress rupture testing was employed to screen these alloys;promising high temperature properties were obtained with the Fe - 50 Co and Co - 15 W base alloys. The microprobe was employed to determine the effects of the various elements on the structure of these two alloys, while metallographic examination of stress rupture test bars was employed to determine the phases associated with failure during testing. The Co - 15 W, 20 Cr, 2 Zr, 2 Ti, 1 C alloy developed in this study, when cast with a chill at the base of the casting, exhibited stress rupture behaviour comparable to the better nickel-base superalloys. Author

N69-40229# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.

QUANTITATIVE MEASUREMENT OF PREFERRED ORIENTATION IN METAL FILMS

C. J. Biver 14 May 1969 12 p refs

(Contract AT(29-2)-656)

(GEPP-60) Avail: CFSTI

The quantitative measurement of preferred orientation in thick (>5000 Å) metal films may be expressed as an inverse pole figure. An expression for the percentage of film volume with a particular (hkl) plane oriented parallel to the metal film surface is derived. This formulation is expressed in terms relative to a randomly oriented sample, which means that the preferred orientation of metal films may be expressed in numerical form. Author (NSA)

N69-40242*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HOT-SALT STRESS-CORROSION OF A TITANIUM ALLOY UNDER A SIMULATED TURBINE-ENGINE COMPRESSOR ENVIRONMENT

Hugh R. Gray and James R. Johnston Washington Oct. 1969 35 p refs

(NASA-TN-D-5510) Avail: CFSTI CSCL 11F

Threshold curves for hot-salt stress-corrosion of the Ti-8Al-1Mo-1V alloy were determined for a variety of exposure conditions that simulated the environment found in a compressor of a gas turbine engine. Specimen surface condition was the

most influential variable. Specimens in the as-machined condition exhibited higher threshold stresses than did stress-relieved specimens. High velocity airflow and high air pressure raised the threshold curves for embrittlement slightly, but did not eliminate embrittlement entirely. Salt concentration, air dewpoint, and salt deposition temperature did not significantly shift threshold curves. Longer exposure times lowered threshold stresses. Author

N69-40344# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METAL CREEP
V. M. Rozenberg. 14 Mar. 1969. 269 p. refs. Transl. into ENGLISH from Polzuchesti Metallov (USSR), 1967. p. 1-276.
(Contract F33657-68-D-0865/P002)
(AD-692186; FTD-HT-23-755-68) Avail: CFSTI. CSCL 11/6.

The book is intended for scientific workers, engineering personnel and aspirants investigating the mechanism of plastic deformation and carrying on research on the use of heat-resistant alloys. The book may also be useful to students of metallurgical and machine-building schools of higher education. The book deals with the mechanism of plastic deformation with creep at elevated temperatures. Data on sliding, deformation at grain boundaries, migration of grain boundaries, formation of substructures, and development of failures under creep conditions are presented. The nature and role of each of these processes in general deformation and their interaction is discussed. Metallurgical methods of quantitative evaluation of each component of plastic deformation are described. Author (TAB)

N69-40372# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
TECHNIQUES OF FABRICATION AND TESTING
In its Fuels and Mater. Develop. Program. May 1969. p. 159-270. refs. (See N69-40368 24-22)
Avail: CFSTI

Economical methods for producing high-quality tungsten and tungsten-alloy tubing with good creep-rupture properties at high temperatures, good microstructural stability, good ductility at low temperatures, and good weldability are studied. Tubing both by modification of conventional techniques based on extrusion, tube reduction, and warm drawing and by direct chemical vapor deposition through the hydrogen reduction of heavy-metal halides were fabricated. Complete physical and metallurgical evaluation of both fabrication processes is included. Author

N69-40379# Boeing Co., Philadelphia, Pa. Vertol Div.
TENSILE PROPERTIES OF TI 7 AL-4 MO HEAVY-SECTION FORGINGS
M. Raefsky. 30 Jan. 1969. 29 p. ref.
(AD-691798; D8-2161-1) Avail: CFSTI. CSCL 13/8

In general, beta forging Ti 7Al-4Mo results in lower tensile properties, especially reduction in area. The best combination of annealed properties occurs on mill annealing followed by a single high (1700F) temperature anneal. The best combination of solution treated properties results from low temperature forging, followed by quenching from 1720F. Yield strength can be increased by quenching from higher temperatures. Over aging at 1250F results in a decrease in tensile and yield strengths, with a corresponding increase in ductility. Solution heat treat temperatures for alpha/beta forged material should not exceed 1720F. Ti 7Al-Mo, in general, is capable of higher solution treated and aged strengths than Ti 6Al-4V. Author (TAB)

N69-40397# Atomic Weapons Research Establishment, Aldermaston (England).
DUCTILE-BRITTLE TRANSITION OF URANIUM
A. N. Hughes, S. Orman, G. Picton, and M. A. Thorne. Mar. 1969. 23 p. refs.
(AWRE-O-21/69) Avail: CFSTI; UK 4s 0d

The mechanical properties of uranium have been studied at -75 to 175°C for four different heat treated conditions of the metal. The elongation and reduction in area-temperature curves are coincident or have identical shapes for 3 of the heat treated conditions, all showing a maximum at about 100°C. Alpha annealed material shows a maximum on the elongation-temperature curve at a slightly higher temperature but the reduction in area increases with temperature over the whole range investigated. In all cases the UTS falls rapidly below room temperature, but this is shown to result from uranium-water interaction. The possible mechanisms for this embrittlement are discussed. Author (NSA)

N69-40405# Junta de Energia Nuclear, Sacavem (Portugal).
SOLDERING PROBLEMS OF NIOBIUM, MOLYBDENUM, TANTALUM, AND TUNGSTEN REFRACTORY METALS [PROBLEMAS NA SOLDADURA DOS METAIS REFRACTARIOS NIOBIO, MOLIBDENIO, TANTALO E TUNGSTENIO]
H. Carvalhinhos. 1968. 31 p. refs. In PORTUGUESE
(LFEN-NI.37/ALPHA/) Avail: CFSTI

The behavior of refractory metals used in welding is studied. The topics discussed are: (1) the importance of refractory metals in modern technology, (2) alloying effects on the properties of the elements, (3) arc welding in inert gases, (4) size of grain effect on ductility of the welds, and (5) aging and superaging. It is concluded that the refractory metals have properties suitable for modern technology, but the difficulties in fabrication, and especially welding limit their use. Transl. by F.O.S.

N69-40430# Martin Marietta Corp., Denver, Colo.
CENTER FOR HIGH ENERGY FORMING
Jimmy D. Mote. 1 Jul. 1969. 24 p. refs.
(Contract DA-19-066-AMC-266(X))
(AD-691750; AMRA-CR-66-05/19; QR-19) Avail: CFSTI. CSCL 13/8

Contents: Explosive bonding, a detonation velocity measurements; Fracture toughness of explosively formed high strength low alloy steel; Microstructural studies of thermally induced diffusion in explosively bonded metals; Recovery processes in explosively formed titanium; Fatigue testing of explosively formed materials; Stress corrosion cracking susceptibility of explosively and conventionally formed 2014 aluminum alloy; Explosive welding; Analysis of edge pull-in during explosive forming of domes; Mechanics of energy transfer of high velocity metal deformation; Analysis of flange wrinkling; Explosive forming of dual hardness armor; Explosive punching of dual hardness armor; and Electromagnetic forming. Author (TAB)

N69-40453 California Univ., San Diego.
HIGH PRESSURE STUDY ON THE SUPERCONDUCTIVITY OF TRANSITION METALS AND ALLOYS
Ching-Wu Chu (Ph.D. Thesis). 1968. 163 p.
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00. Order No. 69-2264)

The results and conclusions of the high pressure measurements on the superconducting transition temperatures T_c (> 1.18°K) of the transition elements, Re, Tc, V, Nb, Ta, alloys Re-Os, Re-W, Re-Mo, V-Cr, and compounds ZrB^{10}_{12}, ZrB^{11}_{12}, and the measurements on the T_c of Re-Ru alloys are presented. T_c of Re exhibits an anomalous pressure dependence which is attributed to change of Fermi surface topology under hydrostatic compression, while that of Tc has a linear pressure dependence with $\partial T_c/\partial P = -(1.25 \pm 0.05) \times 10^{-5}$ °K bar^{-1}. The variation of T_c and $\partial T_c/\partial P$ of Re with the additions of different solutes suggests that the existence of a half-filled d-shell electron configuration is essential for the appearance of any symmetry of the superconducting properties in agreement with this hypothesis. Dissert. Abstr.

N69-40466# California Univ., Berkeley. Lawrence Radiation Lab.
VISCOSITY OF URANIUM METAL AND SOME URANIUM-CHROMIUM ALLOYS
James Single Finucane. May 1969. 54 p. refs.
(Contract W-7405-eng-48)

(UCRL-16988) Avail: CFSTI

An oscillating crucible viscometer capable of precise viscosity determinations above 1000°C was constructed. The operating details were developed and the viscosity of uranium metal and two uranium-chromium alloys was measured. Author (NSA)

N69-40475# Cornell Univ., Ithaca, N.Y.
OBSERVABLE MANY BODY EFFECTS IN METALS
John W. Wilkins 1968 138 p refs
(Contract Nonr-401(38))
(AD-691296; TR-32) Avail: CFSTI CSCL 20/12

Contents: Effective electron-electron interaction in metals; Electron-phonon interaction; Fermi liquid theory. TAB

N69-40480# Brown Univ., Providence, R.I. Engineering Div.
ON THE STRUCTURE OF STRESS STRAIN RELATIONS FOR TIME DEPENDENT PLASTIC DEFORMATION IN METALS
J. R. Rice Jun. 1969 45 p refs
(Contract N00014-67-A-0191-000313)
(AD-691785; TR-4) Avail: CFSTI CSCL 11/6

The paper is concerned with the structure of multiaxial stress-strain relations in time-dependent metal plasticity, as for transient creep and rate sensitive yielding. First, a general kinematical relation is developed between the macroscopic inelastic strain tensor and microstructural slip displacements, as modeled either by continuum shearing on crystallographic planes of individual grains or by the motion of discrete dislocation lines. It is assumed that at any given slipped state, the rate of slipping on a particular system is governed by the resolved shear stress on that system (or by the local forces on dislocation lines). This leads to the primary result of the paper: Components of the macroscopic inelastic strain rate tensor are derivable, at each instant in the course of deformation, from a potential function of stress. General features of the flow potential surfaces in stress space are discussed, and some specific functional forms are examined. Linear viscoelasticity and time-independent plasticity are developed as limiting cases of the flow potential formulation, and the appropriateness of a potential function for stationary creep is discussed. Author (TAB)

N69-40505# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
THE FERMI SURFACE OF METALS AND OF DILUTE ALLOYS OF BERYLLIUM Final Report
W. L. Gordon and T. G. Eck 23 Jul. 1969 17 p refs
(Grants AF-AFOSR-536-66; AF-AFOSR-1637-69)
(AD-691851; AFOSR-69-1990-TR) Avail: CFSTI CSCL 20/12

A de Haas-van Alphen study of the Fermi surface of Be and its dilute alloys with Cu is described, together with a successful parameterization of their band structure based on a non-local pseudopotential model. Strain and temperature dependence of this model are included to illustrate its versatility. Preliminary results on the Fermi surface of the unusually brittle intermetallic compound $MgCu_2$ and on the use of the RF size effect to study electron mean-free-path effects are presented. Cyclotron resonance studies in very high purity Mg are summarized. Author (TAB)

N69-40511# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
THE INFLUENCE OF HYDROSTATIC PRESSURE ON DIFFUSION IN METALS HAVING A CUBIC STRUCTURE [CONTRIBUTION A L'ETUDE DE L'INFLUENCE DE LA PRESSION HYDROSTATIQUE SUR LA DIFFUSION DANS LES METAUX CUBIQUES]
Michel Beyeler (Ph.D. Thesis--Paris Univ.) Jul. 1969 134 p refs In FRENCH; ENGLISH summary
(CEA-R-3715) Avail: CFSTI

To obtain information on the structure of vacancies, the activation volumes for self-diffusion in different face-centered cubic metals, e.g. silver, gold, copper, aluminum and in body centered cubic uranium (γ phase) have been determined by different experiments under high pressure. Activation volumes for impurity diffusion of the noble metals in aluminum have also been investigated. The experimental results for gold, silver and copper are in agreement with most of the theoretical models. The estimated activation volume of self-diffusion for γ uranium seems to indicate a vacancy mechanism. The results for aluminum for both self and impurity diffusion agree quite well with Friedel's theoretical predictions. Author (ESRO)

N69-40519# Surrey Univ., London (England). Dept. of Metallurgy and Materials Technology.
DISLOCATION ATMOSPHERE FORMATION AND STRAIN-AGEING EFFECTS IN NIOBIUM
Z. C. Szkopiak Risley, Engl. UKAEA 1969 16 p refs
(TRG-1797) Avail: CFSTI; HMSO: 2s

Yield point return and internal friction results of strain-aging in niobium were analyzed using the Cottrell–Bilby $t^{2/3}$ law of solute segregation. It was suggested that the difference in the kinetics of aging, as measured by the two techniques, is primarily affected by the dislocation structure prior to aging. Calculations, from the internal friction results, produce dislocation densities which are proportional to the square root of both the true strain and total oxygen content. Dislocation atmosphere densities have also been found to be proportional to the square root of oxygen content. The k_y and $\Delta\sigma_f$ parameters, given by $\Delta\sigma_y = \Delta\sigma_f + 2k_y d^{-1/2}$, were correlated with dislocation atmosphere densities. The k_y parameter is directly proportional to the number of atoms in the Cottrell atmosphere, the density of which appears to be dependent on the total oxygen content. $\Delta\sigma_f$, on the other hand, shows a logarithmic relationship with "outer atmospheres." The total dislocation atmosphere density for the fully-strain-aged condition is about 2.5 times the Cottrell atmosphere density. Author (NSA)

N69-40546# Brown Univ., Providence, R.I. Div. of Engineering.
A FINITE ELEMENT FORMULATION FOR PROBLEMS OF LARGE STRAIN AND LARGE DISPLACEMENT
Hugh D. Hibbitt, Pedro V. Marcal, and James R. Rice Jun. 1969 37 p refs
(Contract N00014-67-A-0191-0007)
(AD-691782; TR-2) Avail: CFSTI CSCL 20/11

An incremental and piecewise linear finite element theory is developed for the large displacement, large strain regime with particular reference to elastic-plastic behavior in metals. The resulting equations, though more complex, are in a similar form to those previously developed for large displacement, small strain problems, the only additional term being an initial load stiffness matrix which is dependent on current loads. This similarity in form means that existing nonlinear general purpose programs may easily be extended to include finite strains. A large displacement, small strain formulation (as applicable to problems of structural stability) is obtained from this theory by assuming that changes in length of line elements and relative rotation of orthogonal line elements are negligible compared to unity. The simplified equations are in essential agreement with previous formulations in the literature. The only difference which is observed is the persistence of the initial load stiffness matrix, which may be significant in some cases. Author (TAB)

N69-40587# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
ELABORATION OF FIBER-REINFORCED METALLIC MATERIALS [ELABORATION DES MATERIAUX METALLIQUES RENFORCES PAR DES FIBRES]
Jean-Marie Martin (Ph.D. Thesis) Aug. 1969 24 p refs In FRENCH; ENGLISH summary
(CEA-R-3832) Avail: CFSTI

A bibliographic study on the elaboration of fiber reinforced metallic materials is presented in three parts: 1) The theory of fiber reinforcement of metals is summarized, with emphasis on the

mechanical and geometric factors which govern the behavior and the performance to be expected from a given composite material. 2) The second part is devoted to the study of the physical and chemical factors related to the structural stability of a given material. 3) Finally, the various processes of fabrication of such composites are presented and discussed. Author (ESRO)

N69-40588# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

STUDY OF INCLUSION COUNTING BY THE COINCIDENCE METHOD [ETUDE DU COMPTAGE DES INCLUSIONS PAR LA METHODE DES COINCIDENCES]

Marcel Jean 1 Jul 1969 31 p In FRENCH; ENGLISH summary (CEA-R-3858) Avail: CFSTI

The counting of inclusions in steel, using polished samples and a microscope, has been studied by size measurement and point counting of high grade and alloy steels because the classical Jernkontorets method often leads to uncertain results. This work was carried out to test the steel casing of the fuel elements of the reactor EL 4. Author (ESRO)

N69-40614# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Mechanical Equipment Development Branch.

ON THE OXIDATION OF ZIRCONIUM ALLOYS IN AIR AND THE DIMENSIONAL CHANGES ASSOCIATED WITH OXIDATION

R. D. Watson Jun 1969 72 p refs

(AECL-3375) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River $1.50

The oxidation rates for zirconium, Zircaloy-2, Zircaloy-4, Zr 2.5 wt% Nb, and Zr-Ti alloys containing titanium in amounts ranging from 0.05 wt% to 10 wt% were determined in air at temperatures in the range from 375° to 800°C. The effects of different surface preparations such as shot-blasting, polishing, machining, etc. on the oxidation rates were investigated for some of the alloys. The dimensional changes associated with oxidation at the different temperatures were determined for several of the alloys using specimens made of sheet, tubing, or bar stock. The effects of wall thickness and oxidation temperature on the dimensional changes of several of the alloys during oxidation were also investigated. Thin walled tubes were internally pressurized during oxidation to determine the relationship between hoop stress and circumferential strain. The diameter and/or length change that occurs during the formation of a given oxide thickness on many of the zirconium alloys increases with increasing oxidation temperature. For Zircaloy-2 and Zr 10 wt% Ti the lengthening of the material during the formation of a given oxide thickness, although not inversely proportional to wall thickness, is greatest when the wall is thinnest. Author

N69-40616# Aeronautical Research Labs., Melbourne (Australia).

THE PREPARATION AND TENSILE PROPERTIES OF CHROMIUM WIRE

F. Henderson, F. P. Bullen, and H. L. Wain Mar 1969 23 p refs

(ARL/MET-64) Avail: CFSTI

Extruded and swaged chromium is readily drawn to wire; reductions in area of at least 99.9% by drawing at 350°C are possible without annealing at higher temperatures. Intermediate annealing introduced to control grain size can cause defects to develop during subsequent drawing. Tensile strengths at room temperature of 2.3×10^5 psi and a ductile/brittle transition temperature around −150°C were achieved. Recovery/recrystallization commenced at 300°C but was only completed at 950°C. A wide-ranging combination of room-temperature strength ($1.1 - 2.3 \times 10^5$ psi) and ductility (2 - 40%) resulted from annealing between 600° and 800°C. Author

N69-40651# Plansee Society for Powder Metallurgy, Reutte (Austria).

SIXTH PLANSEE SEMINAR PREPRINTS, VOLUME 1

1968 623 p refs Partly in ENGLISH; partly in GERMAN; partly in FRENCH Presented at Reutte, Austria, 24 - 28 Jun. 1968 Submitted for publication

Avail: CFSTI

Various refractory metals and heat resistant alloys are produced from metal powders and their mechanical and corrosion resistant properties are analyzed. The technological applications of metal matrix composites are emphasized. For individual titles see N69-40652 through N69-40673.

N69-40652# Plansee Society for Powder Metallurgy, Reutte (Austria).

EXAMPLE DETERMINATIONS OF EQUILIBRIUM PHASE DIAGRAMS IN REFRACTORY METAL SYSTEMS [EXEMPLES DE DETERMINATION DE DIAGRAMMES D'EQUILIBRE DE PHASES DE SYSTEMES DE METAUX REFRACTAIRES]

C. Allibert, J. Driole, and E. Bonnier *In its* 6th Plansee Seminar Preprints, Vol. 1 1968 19 p refs In FRENCH (See N69-40651 24-17)

Avail: CFSTI

Two examples are given for phase diagram refractory systems; the separation of tantalum - niobium, and studies on the production of perfect homogeneous compositions of solid niobium - tungsten solutions. The procedure utilized the division method and the centrifugal machine at high temperature under atmospheric control. Results indicate it is impossible to separate niobium from tantalum using this method, but niobium - tungsten production results were good. Transl. by E.H.W.

N69-40653# Technische Hogeschool, Eindhoven (Netherlands).

REACTION DIFFUSION BETWEEN TWO METALS INCLUDING TITANIUM AND NIOBIUM

G. D. Rieck, G. F. Bastin, and F. J. J. van Loo *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 16 p refs (See N69-40651 24-17)

Avail: CFSTI

By using a technique of diffusion couples and a modified calculation method for diffusion coefficients from observed concentration gradients, most of the layer growth characteristics have been determined in the nickel aluminum, titanium aluminum, titanium nickel, and niobium aluminum systems. Preliminary results in the Ti - Al system indicated that up to 650°C only $TiAl_3$ grows. All other layers grow regularly above 700°C. In Ti - Ni, the TiNi layer is the thickest; above 720°C a new layer of a solid solution of Ni and Ti grows very rapidly. In the Nb - Al system, the first compound formed is $NbAl_3$, which grows very slowly below 630°C and more reasonably fast above the melting point of aluminum. The Nb_2Al layers grow at 1200°C according to the parabolic law. It depends on the nature of the diffusion couple whether Al or Ni is the moving atom due to the great stability of the intermetallic phases. Author

N69-40654# Ministry of Defence, Tel-Aviv (Israel). Scientific Dept.

COMPACTING AND SINTERING OF TUNGSTEN POWDER MIXTURES

J. Barta and E. Ariel *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 16 p refs (See N69-40651 24-17)

Avail: CFSTI

The compacting and sintering behavior of ternary mixtures of well-defined tungsten have been investigated. Powders of 45 - 74 microns (coarse), 9.5 microns (medium) and 0.8 microns average particle diameter were mixed and compacted, the highest density obtained being 14.4 g/cm^3 for a mixture containing 10% coarse, 70% medium and 20% fine. For comparison compacts from fine tungsten powder gave a green density of 10.5 g/cm^3. The experimental results do not agree with compositions and maximum densities calculated on the basis of maximum theoretical packing.

The mechanical strength of the pellets has also been investigated. The compacts were presintered at 1450°C in dry hydrogen and sintered at between 2200 and 2600°C in vacuum (10^{-5} mm Hg). The densities obtained varied from 80% to 95% of T.D., the results showing that the sintering equations based on theoretical models cannot be applied to practical systems in which the particle size distribution is varied non-uniformly. It has been shown that use of a suitably designed mixture of tungsten powders gives the following advantages of technological significance: a) high green and sintered densities can be obtained; b) the density and, hence, the porosity of the sintered compact can be easily controlled; c) improvement in green strength can be obtained. Author

N69-40655# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.

SINTERING OF DOPED TUNGSTEN POWDER

D. M. Moon, R. Stickler, and A. L. Wolfe *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 2 p (See N69-40651 24-17)

Avail: CFSTI

The present investigation is concerned with the effects of trace elements such as Si, Al, and K on the powder size and morphology, and the role these impurity elements play in the sintering process. An electron microscope study of replicas of tungsten oxides and reduced powders subjected to heat treatments in vacuum and hydrogen atmospheres revealed the effect of such heat treatment temperature and atmosphere on particle morphology and impurity distribution. Extraction replicas of tungsten powders contained very fine insoluble residual particles which decreased in particle size and amount with increasing heat treatment temperature. This decrease was accompanied by a drastic reduction in Si and Al concentration, as determined by high-sensitivity chemical analytical techniques. Author

N69-40656# Osram-Studiengesellschaft, Augsburg (West Germany).

DIFFUSION AND TRANSPORT REACTIONS IN AND ON TUNGSTEN [DIFFUSIONS-UND TRANSPORTVORGAENGE IN UND AN WOLFRAM]

G. M. Neumann *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 41 p refs In GERMAN (See N69-40651 24-17)

Avail: CFSTI

The results of the investigations on transport phenomena in tungsten surface-diffusion, grain-boundary-diffusion, volume-diffusion, electro-transport and thermo-transport as well as the results of the investigations on point defects - vacancy formation energy and migration energy - are reviewed and discussed critically. It turns out that the results of the investigations on surface diffusion may be interpreted by means of the method of Stranski - Suhrmann considering the different attraction ratios of the atoms in the course of the diffusion process. The results of the investigation on volume-diffusion may be interpreted assuming a diffusion mechanism on the combined formation and migration of vacancies and divacancies which is in good agreement with experiment. Author

N69-40657# General Electric Co., Ltd., Wembley (England). Hirst Research Centre.

THE OXIDATION CHARACTERISTICS OF TUNGSTEN-CHROMIUM-PALLADIUM ALLOYS

D. S. Evans *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 28 p refs Sponsored by Min. of Technol. (See N69-40651 24-17)

Avail: CFSTI

Tungsten-chromium-palladium alloys containing typically 10% Cr and 1% Pd by weight show good oxidation resistance when heated in air. Typical lives of specimens 0.5 cm diameter 2.5 cm long are 500 h at 1200°C, 100 h at 1400°C and 1 h at 1800°C. The alloys show low rates of weight gain during their oxidation life, in the range 0.01 to 1.5 mg cm^{-2} h^{-1}, but eventually fail catastrophically. Their oxidation resistance is substantially unaffected by severe thermal cycling, and the alloys show good self-healing characteristics when heated to high temperatures. The protection mechanism appears to be due to the presence of an oxidation resistant palladium-rich phase which can form, even under conditions of rapid oxidation, a continuous protective layer over the highly oxidisable tungsten-rich matrix. Author

N69-40658# Philips Gloeilampenfabrieken N. V., Eindhoven (Netherlands).

THE INFLUENCE OF ANNEALING ON THE RECRYSTALLIZATION BEHAVIOUR AND THE MECHANICAL PROPERTIES OF DOPED AND UNDOPED MOLYBDENUM WIRE

F. A. M. M. van Meel, A. C. van Maaren, and G. J. van Weezel *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 48 p refs (See N69-40651 24-17)

Avail: CFSTI

The recrystallization behaviour of molybdenum wire is strongly influenced by the presence of small quantities of K and Si. These dope elements are added in the form of oxides while preparing the powder. By varying the annealing conditions at a certain wire diameter the amount of lattice defects at a smaller diameter can be controlled. Investigated is the influence of such annealing variations at a bigger diameter on the recrystallization behaviour at a smaller diameter; included are doped and undoped molybdenum. Author

N69-40659# Deutsche Akademie der Wissenschaften zu Berlin (East Germany). Institut fuer Metallische Spezialwerkstoffe.

GRAIN BOUNDARY SEPARATIONS IN MOLYBDENUM AND TUNGSTEN; THEIR EFFECT ON SOME PROPERTIES OF THESE METALS [KORNGRENZENAUSSCHEIDUNGEN IN MOLYBDAEN UND WOLFRAM - IHR EINFLUSS AUF EINIGE EIGENSCHAFTEN DIESER METALLE]

R. Krumphold *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 36 p refs In GERMAN (See N69-40651 24-17)

Avail: CFSTI

Microfractiographic analyses on sintered and melted molybdenum and tungsten structures established the intercrystalline fractionation lines of oxides and carbide deposits. Carbide formation along grain boundaries in the lattice matrix insured adequate hot and cold working properties. Low fracture resistance and slip tendency of the polycrystalline molybdenum were attributed to oxide and carbide layers in the deformed lattice. Transl. by G.G.

N69-40660# Battelle Memorial Inst., Columbus, Ohio. Metal Science Group.

ELEVATED TEMPERATURE DEFORMATION AND FRACTURE OF A PRECIPITATION HARDENED MOLYBDENUM ALLOY

B. A. Wilcox, A. Gilbert, and B. C. Allen *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 29 p refs (See N69-40651 24-17)

Avail: CFSTI

The deformation and fracture characteristics of molybdenum-TZM (Mo-0.5Ti-0.1Zr-0.001 to 0.019 C) have been studied over the temperature range 200-1850°C, with emphasis on evaluating the influence of strain rate, structural condition, and carbon content on the mechanical behavior. Three alloys, containing 10, 100, and 190 ppm of carbon, respectively, were evaluated in both the wrought-stress-relieved and recrystallized conditions at tensile strain rates of 0.01, 2, and 600 min^{-1}. The yield and ultimate strengths of the wrought-stress-relieved alloys decreased continuously with increasing temperature. However, for recrystallized alloys it was found that dynamic strengthening occurred in the temperature range 1000-1650°C. This resulted in strength peaks, which were much more pronounced in the two higher carbon

alloys than in the alloy containing 10 ppm C. This effect is attributed to dynamic precipitation of carbides during deformation. Associated with the strength peaks was a marked ductility decrease caused by severe grain boundary cracking. This effect is rationalized phenomologically in terms of the relative shear strengths of the matrix and the grain boundaries. In the range ≈1000-1650°C, grain boundary sliding leads to intergranular cracking and the cracks propagate to failure. Author

N69-40661# Oxford Univ. (England). Dept. of Metallurgy.
HARDENING OF SOME MOLYBDENUM-BASED ALLOYS BY PRECIPITATION OF NITRIDE AND CARBIDE PHASES
N. E. Ryan and J. W. Martin. *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 40 p refs (See N69-40651 24-17)
Avail: CFSTI

The feasibility of classical precipitation-hardening by quench-ageing treatments has been demonstrated in molybdenum, using carbides or nitrides of the Group IVa elements. Thin foil specimens for electron microscopy have been prepared from each alloy at different stages of ageing. Similar patterns of precipitation behaviour were observed at each ageing temperature, and the following conclusions have been made: (1) The carbides and nitrides of both Hf and Zr precipitate as plates with {100} habit planes. The Zr compounds both appear to precipitate preferentially on matrix dislocations, whereas the Hf compounds are more widely distributed. (2) The titanium carbide and nitride precipitates do not exhibit a low-index habit plane. (3) The precipitation sequence in the Mo-TZC alloy was closely similar to that observed in the simple Mo-Ti-O alloy, with the important distinction that the habit plane of the complex carbide precipitate was {100}. It is concluded that it is the influence of the zirconium in the Mo-TZC which dictates the habit-plane selected by the precipitate. Author

N69-40662# Union Carbide European Research Associates, Brussels (Belgium).
REFRACTORY METAL FIBER REINFORCED COMPOSITES
A. Berghezan. *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 39 p refs (See N69-40651 24-17)
Avail: CFSTI

The fiber reinforced concept was used to prepare new materials possessing higher performances than the existing superalloys in the temperature range where the superalloys do not conserve any useful strength, namely, in the 900° - 1200°C range. This high temperature objective imposes a very restricted selection of the components which have to be combined in the composite structure. The second objective of this investigation was to find whether the development of a high temperature composite material is possible utilizing only already existing ("off-the-shelf") materials in order to get a competitive material also on a price basis. Finally, the third objective was to explore the potentials of the coextrusion of fibers and matrix as a method of fabrication of fiber reinforced composites. Author

N69-40663# Commissariat a l'Energie Atomique, Paris (France). Departement de Metallurgie.
PRODUCTION OF TRANSITION METALS BY DECARBONIZATION REACTIONS [OBTENTION DES METAUX DE TRANSITION REACTIFS PAR CARBOREDUCTION]
J. Trouve and A. Accary. *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 32 p refs In FRENCH (See N69-40651 24-17)
(DM-1711) Avail: CFSTI

It is shown that the decarbonation transition metal reaction unites to form the complex reaction MO + C -CO + M. The role revealed by the appearance of inferior oxides, carbons, and that of oxycarbons in which high temperature reduction determines part of the thermodynamic constants relative to the reaction is studied. Included is the final stage of decarbonation, and evidence is given for the existence of one residual oxygen. Theories are deduced for the proper operation conditions to produce a high purity metal reaction. Transl. by E.H.W.

N69-40664# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
ON THE PRECIPITATION BEHAVIOR OF NIOBIUM ALLOY D-43 (Nb-10W-1Zr-0.1C)
Friedrich Ostermann and Franz Bollenrath (Tech. Hochschule Aachen (West Ger.) *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 42 p refs (See N69-40651 24-17)
Avail: CFSTI

The formation of precipitate phases in niobium alloy D-43, nominal composition Nb-10W-1Zr-0.1C, was investigated by metallography and X-ray diffraction analysis of chemically extracted phases. Complete solution of carbide phases occurred at and above 1650°C. The time and temperature dependence of precipitation of the equilibrium carbide phase, a zirconium-rich monocarbide (Zr,Nb)C, was shown to be influenced by the cooling rate after solution annealing. The improvement of room temperature ductility during aging seems to be related to the dissolution of the carbide phase at grain boundaries. Precipitation of metastable niobium carbides prior to the formation of (Zr,Nb)C depletes the matrix of carbon supersaturation and, therefore, reduces the driving force for (Zr,Nb)C precipitation. Evidence of increasing carbide solutioning was found after heating at temperatures above 1200°C, hence coagulation of equilibrium carbides can be expected in this temperature range. Author

N69-40666# Metallgesellschaft, A. G., Frankfurt am Main (West Germany). Metall-Laboratorium.
DEVELOPMENT OF HIGH HEAT RESISTANT AND CORROSION RESISTANT VANADIUM BASE ALLOYS FOR NUCLEAR TECHNOLOGY [ENTWICKLUNG HOCHWARMFESTER UND KORROSIONSBESTAENDIGE LEGIERUNGEN AUF VANADINBASIS FUER DIE KERNTECKNIK]
H. Boehm, H.-U. Borgstedt, M. Ruehle, and P. Wincierz. *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 40 p refs In GERMAN (See N69-40651 24-17)
Avail: CFSTI

Titanium, chromium, niobium, and molybdenum alloys with vanadium base were studied for their ductility, heat resistance, corrosion resistance, and heat transfer properties. The ductility of most precipitation hardened vanadium alloys was greatly improved by additions of titanium and zirconium; titanium-vanadium-niobium alloys were formed into cladding pipes of 7mm × 0.4 mm diameter. The heat resistance of binary vanadium titanium alloys increased greatly with increasing titanium content and reached a reaction time maximum at a titanium concentration of ≤ 3%. Addition of ternary niobium increased thermal resistance even further. Corrosion resistance to sodium flow was very poor for the systems vanadium-titanium and vanadium-titanium-niobium; only the addition of chromium seemed to have a corrosion retarding effect. Heat conductivity of the vanadium-titanium-niobium alloys increased with higher temperatures and was about equal or higher than that of nickel alloys or austenitic steels. Transl. by G.G.

N69-40667*# Ilikon Corp., Natick, Mass.
DEVELOPMENT OF STABILIZED PRECIPITATION HARDENED ALLOYS
L. J. Bonis and R. M. Rogers. *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 35 p refs Supported by NASA (See N69-40651 24-17)
Avail: CFSTI

A novel method of preparing a dispersion strengthened alloy is being introduced. This method, known as STAP (STAbilized Precipitate), involves using natural precipitation process to establish the "blueprint" of particle distribution and subsequent stabilization.

not unlike internal oxidation, to create the final dispersion phase for strengthening, thereby utilizing the fine dispersion of precipitation process coupled with oxide dispersion stability. Initial studies have been carried out in the Ni-Cr-Al-Ti system, using −325 mesh powders as the starting materials. The feasibility of the process has been demonstrated, but several areas remain to be studied in greater detail. Electron micrographs of typical structures obtained are presented. Author

N69-40668# General Electric Co., Schenectady, N.Y. Materials and Processes Lab.

THE ROLE OF REFRACTORY METALS IN AUSTENITIC SUPERALLOYS

Chester T. Sims *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 44 p refs (See N69-40651 24-17)

Avail: CFSTI

Refractory metals play a vital role as major alloying elements in superalloys. Quantities of up to 20% of tungsten, molybdenum, tantalum, and columbium are used in high-temperature alloys, such as those powering gas turbines and nuclear reactors. The specific and critical function of refractory metals in superalloys is examined carefully in this paper. Results are presented based on recent work from this laboratory in determining the partitioning of refractory metals in the microstructure, the effect of refractory metals on phase relations, and the use of electron density theory in computerized calculations (PHACOMP) to control and optimize the amounts of refractory metals added. Conclusions from the work are then presented to show how refractory metal atoms contributed specifically and beneficially to strength and ductility through solid-solution strengthing and carbide formation. It is further shown that electron density calculations have eliminated much needless alloy development and are now utilized in commercial procurement of refractory-metal-containing superalloys. Author

N69-40669# IIT Research Inst., Chicago, Ill.

PROPERTIES OF SUPERALLOYS MADE BY HOT WORKING OF PREALLOYED POWDERS

N. M. Parikh *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 32 p (See N69-40651 24-17) (Contract AF 33(657)-9140)

Avail: CFSTI

Melts of superalloys such as Inconel 713C, PH 15-7 Mo, and Udimet 700 were converted into high purity powders. The powders were then converted into wrought materials by hot extrusion or hot forging. Mechanical property measurements of the wrought products indicate that the products fabricated from powders are superior to those made from castings. Particularly, the powder metallurgy T-section of Inconel 713C shows almost a two-fold improvement in moderate temperature (up to 1400°F) tensile properties over the cast alloy. The other alloys were comparable in properties to the commercial wrought products but showed a greater ease of fabricability. The paper also describes the effect of fabrication variables on properties. Author

N69-40670# General Electric Co., Ltd., Wembley (England). Hirst Research Centre.

A SINTERED NICKEL-BASE SUPERALLOY SUITABLE FOR GAS TURBINE BLADES

J. F. Strachan and A. J. R. Soler-Gomez *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 53 p refs (See N69-40651 24-17)

Avail: CFSTI

The sintered nickel-base alloy N15 has a stress-rupture life equivalent to that of the best wrought nickel-base alloy, Nimonic 115. Shaped turbine blade blanks, made in sintered N15 by an isostatic pressing and sintering process, were machined and tested. A severe special-category engine test to current flight-clearance conditions was completed successfully; there was no evidence of corrosion, cracking or necking of the blades after the test. The stress-rupture, tensile and fatigue strength, impact strength, thermal shock and thermal expansion properties of sintered N15 are given and the fabrication of sintered turbine blade blanks described. The microstructure of the alloy, determined by X-ray, electron-microscopic and X-ray probe microanalysis techniques is presented. The relationships between the microstructure and the mechanical properties are discussed. Author

N69-40671# Birmingham Univ. (England). Dept. of Physical Metallurgy and Science of Materials.

VOID NUCLEATION AND GROWTH DURING THE LOW-TEMPERATURE DEFORMATION OF NICKEL-COBALT-ALUMINA ALLOYS

J. W. Hancock, I. L. Dillamore, and R. E. Smallman *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 27 p refs (See N69-40651 24-17)

Avail: CFSTI

The mechanical behaviour of a nickel, and nickel-60% cobalt alloy strengthened with 2-1/2vol.% alumina has been investigated by carrying out tensile tests to study the influence of matrix stacking fault energy, and hence work-hardening rate, on plastic instability and ductility; the addition of cobalt lowers the stacking fault energy and increases the work-hardening rate. Transmission electron microscope observations show that the cobalt addition appreciably lowers the particle-matrix interfacial energy, decreases the voiding on particles at a given deformation strain and appreciably increases the amount of tensile ductility. An appreciable effect of matrix work-hardening was also found on strain prior to necking. These results are discussed in terms of current theories of void nucleation and void growth and allow predictions to be made concerning the magnitude of the uniform and necking strain in two phase alloys. Author

N69-40672# Metaalinstituut TNO, Delft (Netherlands).

ZIRCONIA COATINGS ON NIMONIC ALLOYS

J. M. Nijpjes *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 33 p refs (See N69-40651 24-17)

Avail: CFSTI

After pretreatment with Al_2O_3 particles to roughen the surface, sprayed ZrO_2 layers were used to protect the nickel super alloy substrate against temperatures above 1.000°C. The coating parameters and the interlayer were varied until a relatively stable substrate coating combination was made. The specimens were tested by thermal cycling. Some specimens could resist a temperature gradient of about 1.000°C over a thickness of 1 mm at which the substrate temperature was up to 1.000°C and the coating temperature up to 2.000°C. The influence of the coating techniques and the coating on the high temperature creep and fatigue properties are also studied. Author

N69-40674# Plansee Society for Powder Metallurgy, Reutte (Austria).

SIXTH PLANSEE SEMINAR PREPRINTS, VOLUME 2

1968 535 p refs Partly in ENGLISH; partly in GERMAN; partly in FRENCH Presented at Reutte, Austria, 24–28 Jun. 1968 Submitted for publication

Avail: CFSTI

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3. KINETICS OF THE CARBIDING REACTION: TANTALUM

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8. THE CREEP BEHAVIOR OF IRON-MOLYBDENUM ALLOYS IN THE TEMPERATURE REGION 500 DEG TO 100 DEG C A. Fuchs, B. Ilschner, and D. Uelze (Erlangen Univ.) 31 p refs (See N69-40682 24-17)

9. STUDIES ON BRITTLE FRACTURE FORMATION IN TITANIUM ALLOYS CAUSED BY HIGH TEMPERATURE OXIDATION U. Zwicker and E. Kalsch (Erlangen Univ.) 7 p refs (See N69-40683 24-17)

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14. PRODUCTION OF REFRACTORY ALLOY POWDERS AND SINTERED BILLETS BY THERMOCHEMICAL TRANSFORMATION P. Galmiche, A. Hivert, and M. Marty 20 p refs (See N69-40688 24-17)

15. COATING PROBLEMS H. Bueckle (Office Natl. d'Etudes et des Recherches Aerospatiales) 2 p (See N69-40689 23-06)

16. NIOBIUM ALLOYS FOR PROTECTION AGAINST OXIDATION P. Stecher, B. Lux, and R. Funk (Battelle Mem. Inst., Geneva, Switz.) 89 p refs (See N69-40690 24-17)

17. SILICON DIFFUSION IN PROTECTIVE SILICIDE PHASE LAYERS OF HIGH MELTING POINT METALS E. Fitzer and K. Matthias 36 p refs (See N69-40691 24-06)

N69-40677# Westinghouse Research Labs., Pittsburgh, Pa.
KINETICS OF THE CARBIDING REACTION: TANTALUM CARBIDE
H. A. Johansen *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 2 1968 28 p refs (See N69-40674 24-17)
Avail: CFSTI

Some features of new industrial applications of refractory "hard metal" materials have required an increased understanding of their preparation. The transition metal carbides of the IV, V, and VI Groups, in particular, show such interesting properties that more exact information on the factors affecting their preparation was sought. Reaction kinetic methods were used which do not appear to have been previously applied. Weight gain measurements by means of a balance technique were obtained as a function of time, temperature, and gaseous atmosphere. A comparison of the thermal and mechanical properties of powder metallurgy carbides vs. gas-carbided material is presented. The problem of gas-carbiding massive metal in depth without destructive distortion is investigated. The role of other interstitials in the carbiding process and the effect of alloying additions in influencing both the rate and extent of carbiding is reported. Author

N69-40681# Rheinisch-Westfalische Technische Hochschule, Aachen (West Germany).
ASPECTS OF PERFORMING STRESS AND CREEP EXPERIMENTS IN HIGH TEMPERATURE VACUUM [GESICHTSPUNKE FUER DIE DURCHFUEHRUNG VON ZUG- UND KRIECH- VERSUCHEN IM VAKUUM BEI HOHEN TEMPERATUREN]
F. Bollenrath, H. Feldman, and G. Happek *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 2 1968 25 p refs In GERMAN (See N69-40674 24-17)
Avail: CFSTI

High temperature tensile and creep behavior of TZM-molybdenum was studied in vacuum. Elongation velocity along the measuring scale was controlled and remained at constant low speed. Temperature fluctuations in measuring time and their effects on metal properties were discussed and relative tensile errors were determined as functions of relative errors in temperature, elongation velocity, elongation, and dimensionless errors modules. Transl. by G.G.

N69-40682# Erlangen Univ. (West Germany). Institut fuer Werkstoffwissenschaften.
THE CREEP BEHAVIOR OF IRON MOLYBDENUM ALLOYS IN THE TEMPERATURE REGION 500 DEG TO 100 DEG C [DAS KRIECHVERHALTEN VON EISEN - MOLYBDAEN-LEGIERUNGEN IM TEMPERATURBEREICH 500 DEG BIS 100 DEG C]
A. Fuchs, B. Ilschner, and D. Uelze *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 2 1968 31 p refs In GERMAN; ENGLISH summary (See N69-40674 24-17)
Avail: CFSTI

Tensile test samples of vacuum-melted iron-molybdenum alloys with up to 15 wt.-pct. Mo have been deformed under constant load in controlled atmosphere in the temperature range 500 to 1000°C. Tensile strain was recorded continuously. Evaluation of the creep curves was much improved by plotting the creep rates logarithmically vs. strain. Changing load and temperature frequently in the course of every run then allowed for detailed results on stress and temperature dependence of the stationary creep rate. The activation energy Q for creep only beyond 850°C (where it amounts to 65 Kcal/Mol) is in rough agreement with the activation energy for diffusion; for lower temperatures, it is much higher (100 Kcal/Mol), and exhibits a singularity at the Curie temperature, which cannot be straightened out by application of the shear modulus correction. The activation volumes, hence the stress dependence, decrease with increasing molybdenum content of the alloy. Author

N69-40683# Erlangen Univ. (West Germany). Institut fuer Werkstoffwissenschaften.
STUDIES ON BRITTLE FRACTURE FORMATION IN TITANIUM ALLOYS CAUSED BY HIGH TEMPERATURE OXIDATION [UNTERSUCHUNGEN AN TITANLEGIERUNGEN ZUR SPROEDRISSBILDING DURCH OXYDATION BEI ERHOETER TEMPERATUR]
U. Zwicker and E. Kalsch *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 2 1968 7 p refs In GERMAN (See N69-40674 24-17)
Avail: CFSTI

Electron microanalytic studies on titanium alloys subjected to high temperature oxidation established brittleness and crack

formation concurrent with a decrease in maximal elongation at prolonged testing times. Creep tests at and above 450°C showed brittle fracture formation after 1000 hours; aluminum and sinter materials were deposited at grain boundaries and surfaces so that the superstructure of an α-mixed crystal was formed. In alloys with polygonal grains intercrystalline brittle fracture was caused by those aluminum deposits at the grain boundaries. Cold forming of the alloys destroyed the grain boundaries and inhibited intercrystalline fracture formation. Transl. by G.G.

N69-40684# Balzers Aktiengesellschaft (Liechtenstein).
A NEW ELECTRON EMISSION MICROSCOPE FOR HIGH TEMPERATURE STUDIES [EIN NEUES EMISSIONS-ELEKTRONENMIKROSKOP FUER HOCHTEMPERATURUNTERSUCHUNGEN]
L. Wegmann and Ch. Zaminer *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 2 1968 16 p refs In GERMAN (See N69-40674 24-17)
Avail: CFSTI

A survey on the application of emission electron microscopy in high temperature metallurgy is presented. Emphasis is placed on the application limits of the various electron resolution mechanisms. Described is also a new photoemission electron microscope and its application in the kinematic registration of tungsten recrystallization processes at 2000°C. Included are photoemission pictures on structural changes in copper during heating to 450°C. Transl. by G.G.

N69-40686# Deutsche Akademie der Wissenschaften zu Berlin (East Germany). Institut fuer Metallphysik und Reinstmetalle.
ON OXYGEN, NITROGEN, AND HYDROGEN DETERMINATION IN HIGH MELTING POINT METALS [ZUR BESTIMMUNG VON SAUERSTOFF, STICKSTOFF UND WASSERSTOFF IN HOCHSCHMELZENDEN METALLEN]
K. Friedrich, E. Lassner (Plansee Soc. for Powder Met), T. Kraus (Balzers Aktienges.), G. Paesold (Balzers Aktienges.), and F. Schlaet *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 2 1968 17 p refs In GERMAN (See N69-40674 24-17)
Avail: CFSTI

Vacuum extraction and other methods are compared for their performance in nitrogen and oxygen analyses on niobium and tantalum powders and compact mixtures. Systematic investigations showed that: (1) the platinum flux method is most valuable for oxygen content determinations in niobium and tantalum powders; (2) high temperature diffusion extraction is suitable for oxygen determinations in compact niobium and tantalum materials; (3) high temperature degassing and molybdenum flux methods are applicable for oxygen determination in niobium melts but not in tantalum melts; and (4) vacuum degassing methods are not satisfactory for nitrogen determinations in the metal powders investigated. Transl. by G.G.

N69-40687# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf.
THE DENDRITIC GROWTH OF MOLYBDENUM, NIOBIUM, AND TANTALUM DURING DEPOSITION FROM GASEOUS PHASE [DAS DENDRITISCHE WACHSTUM VON MOLYBDENUM, NIOBIUM, UND TANTALUM BEI DER ABSCHEIDUNG AUS DER GASPHASE]
P. Koss and K. Rotter *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 2 1968 20 p refs In GERMAN (See N69-40674 24-17)
Avail: CFSTI

Investigated was the pentachloride hydrogen reduction method for obtaining metallic molybdenum, niobium, and tantalum from gaseous phases. Metal halogenide vapors were reduced in a hydrogen atmosphere and deposited on heated metal screens and wires made from tungsten, tantalum, niobium, etc. Deposition layer growth for all three metals started with a fine grained layer, followed by a dendritic 111 layer and final dendrites with 100 orientation. Each of the successive depositon forms corresponded to a pronounced temperature regimes during deposition that varied with the individual metals. Thermodynamic evaluation established the lowest temperature deposition regimes for molybdenum and the highest temperature depositions for tantalum. Dendritic growth in the 111 direction was attributed to a rapid reduction in the 110 direction caused by the absence of crystal nuclei. Transl. by G.G.

N69-40688# Plansee Society for Powder Metallurgy, Reutte (Austria).
PRODUCTION OF REFRACTORY ALLOY POWDERS AND SINTERED BILLETS BY THERMOCHEMICAL TRANSFORMATION [ELABORATION D'ALLIAGES REFRACTAIRES EN POUDRES, EN FIBRES ET EN BILLETTES FRITTEES PAR VOIE THERMOCHIMIQUE]
Philippe Galmiche, Andre Hivert, and Michel Marty *In its* 6th Plansee Seminar Preprints, Vol. 2 1968 20 p refs In FRENCH (See N69-40674 24-17)
Avail: CFSTI

The ONERA process of metallic cementation in the gaseous phase was applied with success to laboratory and industrial scales for the production of refractory alloy powders and sintered billets. The principles and general conditions in thermochemical practices are reviewed. Results are described and particular attention is given to the complex matrix dispersion phase of type T.D. nickel alloys. Transl. by E.H.W.

N69-40690# Battelle Memorial Inst., Geneva (Switzerland).
NIOBIUM ALLOYS FOR PROTECTION AGAINST OXIDATION [PROTECTION CONTRE L'OXYDATION D'ALLIAGES DE NIOBIUM]
P. Stecher, B. Lux, and R. Funk *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 2 1968 89 p refs In FRENCH (See N69-40674 24-17)
(PS/RF/BL/mw; Z-561-6) Avail: CFSTI

Niobium alloys of aluminum and silicon are investigated for their protective qualities against oxidation at high temperatures. It was noted that the alloys possess good oxidation resistance, possess high fusion points, and show good compatibility with other compounds. Fabrication methods for silicon and aluminum coatings are also discussed. Transl. by E.H.W.

N69-40692# Plansee Society for Powder Metallurgy, Reutte (Austria).
SIXTH PLANSEE SEMINAR PREPRINTS, VOLUME 3
1968 286 p refs Partly in ENGLISH; partly in GERMAN; partly in FRENCH Presented at Reutte, Austria, 24-28 Jun. 1968 Submitted for publication
Avail: CFSTI

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2. CONFIGURATION MODEL OF LOCALIZED VALENCE ELECTRONS G. V. Samsonov 35 p refs (See N69-40694 24-06)

3. APPLICATION OF REFRACTORY MATERIALS AS DIFFUSION BARRIERS P. J. Chao (RCA, Harrison, N.J.) 14 p refs (See N69-40695 24-18)

4. ON THE CARBIDOTHERMAL PRODUCTION OF METALS OF THE IVA, VA, AND VIA GROUPS AND THEIR ALLOYS R. Kieffer, F. Lihl, and E. Effenberger 26 p refs (See N69-40696 24-17)

5. COMPARISON OF DIFFERENT HAFNIUM PURIFICATION METHODS M. Armand, J. P. Givord, and R. Herold (Labs. de Recherches, Venthon, France) 24 p refs (See N69-40697 24-17)

6. PROPERTIES OF SUPERALLOYS MADE BY HOT

WORKING OF PREALLOYED POWDERS. N. M. Parikh (IIT Res. Inst., Chicago, Ill.) 32 p refs (See N69-40698 24-17)

7. A SINTERED NICKEL-BASE SUPERALLOY SUITABLE FOR GAS TURBINE BLADES. J. F. Strachan and A. J. R. Soler-Gomez (GE Ltd., Wembley, Engl.) 52 p refs (See N69-40699 24-17)

8. VAPOR DEPOSITION OF REFRACTORY MATERIALS. A. M. Shroff. 35 p refs (See N69-40700 24-17)

9. CORROSION RESISTANT COATINGS FOR REFRACTORY METALS AND SUPERALLOYS. J. D. Gad (TRW Equipment Labs.) 51 p refs (See N69-40701 24-18)

N69-40696# Plansee Society for Powder Metallurgy, Reutte (Austria).

ON THE CARBIDOTHERMAL PRODUCTION OF METALS OF THE IVA, VA AND VIA GROUPS AND THEIR ALLOYS [UEBER DIE KARBIDOTHERMISCHE HERSTELLUNG VON METALLEN DER IVA-, VA- UND VIA-GRUPPE UND DEREN LEIGERUNGEN]

R. Kieffer, F. Lihl, and E. Effenberger. *In its* 6th Plansee Seminar Preprints, vol. 3 1968 26 p refs In GERMAN (See N69-40692 24-17)

Avail: CFSTI

Described is a carbide oxygen reduction method for the production of chromium, molybdenum, and tungsten metals and their alloys. This method was difficult to use in vanadium, niobium, and tantalum processing because of the formation of eutectic melts close to reaction temperatures. Low carbon monoxide equilibrium pressures and the stability of the oxicarbides during the last reaction step made this method unsuitable for reduction of titanium, zirconium, and hafnium metals. Transl. by G.G.

N69-40697# Laboratoires de Recherches, Venthon (France).

COMPARISON OF DIFFERENT HAFNIUM PURIFICATION METHODS [COMPARAISON ENTRE DIFFERENTS MODES DE PURIFICATION DU HAFNIUM]

M. Armand, J. P. Givord, and R. Herold. *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, vol. 3 1968 24 p refs In FRENCH (See N69-40692 24-17)

(LRV/RH/YG-R.T.68.030) Avail: CFSTI

The sponge of hafnium obtained through the reduction of tetrachloride from magnesium still contained several elements as oxygen and nitrogen in weak qualities. Their presence renders disadvantages on the ductility characteristics and difficulties in obtaining direct utilization of ingots for consumable electrodes in the arc furnace. Three purification methods were studied. They are Van Arkel method, electrolysis of soluble anodes in a molten salt medium, and the slow fusion of electron bundles to the furnace. Results show several impurity variations, but electronic bombardment provides some form of direct utilization of the ingots.

Transl. by E. H. W.

N69-40698# ITT Research Inst., Chicago, Ill.

PROPERTIES OF SUPERALLOYS MADE BY HOT WORKING OF PREALLOYED POWDERS

N. M. Parikh. *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 3 1968 32 p refs (See N69-40692 24-17)

(Contract AF 33(657)-9140)

Avail: CFSTI

Melts of superalloys such as Inconel 713C, PH 15-7 Mo, and Udimet 700 were converted into high purity powders. The powders were then converted into wrought materials by hot extrusion or hot forging. Mechanical property measurements of the wrought products indicate that the products fabricated from powders are superior to those made from castings. Particularly, the powder metallurgy T-section of Inconel 713C shows almost a two-fold improvement in moderate temperature (up to 1400° F) tensile properties over the cast alloy. The other alloys were comparable in properties to the commercial wrought products but showed a greater ease fabricability. The effect of fabrication variables on properties is also described. Author

N69-40699# General Electric Co., Ltd., Wembley (England). Central Research Labs.

A SINTERED NICKEL-BASE SUPERALLOY SUITABLE FOR GAS TURBINE BLADES

J. F. Strachan, and A. J. R. Soler-Gomez. *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 3 1968 refs 52 p *Its* Commun. No. 1254 (See N69-40692 24-17)

Avail: CFSTI

The stress--rupture, tensile and fatigue strength, impact strength, thermal shock, and thermal expansion properties of sintered nickel-base alloy N15 are given, and the fabrication of sintered turbine blade blanks is described. The microstructure of the alloy, determined by X-ray, electron microscope and X-ray probe microanalysis techniques, is presented. The relationships between the microstructure and the mechanical properties are discussed. The importance of the grain boundary phases is stressed, and some current problems in their detailed identification are considered. Author

N69-40700# Plansee Society for Powder Metallurgy, Reute (Austria).

VAPOR DEPOSITION OF REFRACTORY MATERIALS

A. M. Smroff (CSP-CEPEC, Orsay, France). *In its* 6th Plansee Seminar Preprints, Vol. 3 1968 35 p refs (See N69-40692 24-17)

(DTW.8751) Avail: CFSTI

It has been shown that the chemical vapor deposition process can be applied to various refractor materials for which a composite exists and which can be either reduced or decomposed. The materials so obtained shows the following properties: (1) highpurity; (2) compacity which alloys to use it as coating material or to make self standing bodies; (3) perferential orientation developed according to deposition parameters; this is important for application in thermionic power generation and X-ray anticathodes; and (4) thin layer deposition of different materials in alternating coatings for manufacturing composite structures. Author

N69-40716# Helsinki Univ. (Finland). Electronics Lab.

LAYER MODEL OF SELENIUM SINGLE CRYSTALS

Timo Salo. 30 Nov. 1967 45 p refs

Avail: CFSTI

The possibility of explaining the dependence of the conductivity and dielectric constant of selenium single crystals upon frequency and static electric field strength by a layer model is investigated. By means of gross approximations the number of layers has been calculated from the results of measurements and the dependence of the above parameters found to be in accordance with the predictions. ESRO

N69-40725# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.

A HIGHLY PURIFIED GAS BLANKET FOR THE CHARGE OF HIGH MELTING REACTIVE METALS AT HIGH TEMPERATURE [EIN HOCHREINES SCHUTZGASSYSTEM FUER DEN EINSATZ HOCHSCHMELZENDER REAKTIVER METALLE BEI HOHEN TEMPERATUREN]

F. Bukau. Dec. 1968 50 p refs In GERMAN

(KFK-927) Avail: AEC Depository Libraries

The use of high melting metals at high temperatures requires a protection of the surface of these metals from undesirable gas absorption. A highly purifed gas blanket for the protection of reactive metals was investigated on Nb and Ta. The effect of H_2, O_2, and N_2 on the properties of Nb and Ta was determined qualitatively and quantitatively. The gas blanket can consist of either argon or helium. The gas blanket system designed and its operation are described. NSA

N69-40825*# Stanford Univ., Calif. Solid-State Electronics Labs.
FUNDAMENTAL STUDIES OF THE METALLURGICAL, ELECTRICAL AND OPTICAL PROPERTIES OF GALLIUM PHOSPHIDE Quarterly Progress Report, 1 Jul. – 30 Sep. 1969
30 Sep. 1969 5 p
(Grant NGR-05-020-043)
(NASA-CR-106399) Avail: CFSTI CSCL 11F

A nickel germanium mixture was evaporated from heavy multistranded tungsten filaments onto gallium phosphide, clipped to a high purity machined graphite heater. After the evaporation the temperature was raised by means of the graphite heater until alloying was seen. The results indicate that with mixtures of 12 to 20 atomic percent germanium, good ohmic contacts are seen at alloying temperatures in excess of 600°C. A graph of Ge – Ni alloying temperatures on GaP as a function of Ge composition is included. F.O.S.

N69-40829# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROPERTIES OF THE DIAGRAMS OF CYCLIC DEFORMATION AT NORMAL TEMPERATURES
A. P. Gusenkov 19 Jun. 1969 51 p Transl. into ENGLISH from Russian publ.
(AD-692358; FTD-MT-24-447-68) Avail: CFSTI CSCL 11/6

The problem involved in systematic experimental investigation of the properties of diagrams of cyclic elastic-plastic deformation as applied to the kinetic of the stressed state is posed. This study is based on an extensive literature survey. The level of the initial deformation or stresses, the number of leading cycles, the type of loading, the deformation rate, and the state of the material were taken as the main factors. Variations in the proportionality limit and in the unloading modules were also determined. Aluminum alloys V-95, AL-8, and D-16T, low-alloy carbon steels 45 and 30 Kh GSA, and high-temperature steels 1 Kh18 N9 T and TS were studied in the form of thin-walled tubes. The parameters were recorded with plus or minus 5 percent accuracy. It was found that the materials can be cyclically strengthened, weakened, or stable. In the first half-cycle of loading, the proportionality limit is independent of the degree of initial deformation. Study of these structural materials, which have different mechanical properties, showed that with respect to the number of loading half-cycles with symmetric loading cycle, the diagram of cyclic elasto-plastic deformation formed a generalized diagram of cyclic deformation, providing a unique relationship between stress and deformations. Author (TAB)

N69-40911# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
DIFFUSION OF INTERSTITIAL SOLUTE-VACANCY PAIRS IN A DILUTE FCC ALLOY
J. Wesley Miller Apr. 1969 31 p refs
(Contract N00014-67-A-0298-0009)
(AD-691382; TR-21) Avail: CFSTI CSCL 20/12

It has been proposed that the diffusion of cadmium in lead, which is inconsistent with the vacancy mechanism of solute diffusion, occurs by means of an interstitial migration which is strongly correlated due to an attraction between interstitial cadmium ions and vacancies. It is plausible that cadmium, like the noble metal solutes, should dissolve in lead by the dissociative mechanism, but interact strongly with vacancies by a screened electrostatic interaction. A thermodynamic model of a dilute dissociative solid solution is developed, and expressions for the equilibrium fractions of substitutional, interstitial and interstitial solute - vacancy close pair solute states are derived. Following the method of Lidiard, the solute diffusivity and linear enhancement of self-diffusion in this dissociative fcc alloy are calculated. It is also shown that the solute correlation factor, and therefore the isotope effect for solute diffusion, must be very small for this mechanism of diffusion. Author (TAB)

N69-40964 Connecticut Univ., Storrs.
STRAIN INDUCED CARBIDE PRECIPITATION IN H-11 STEEL
Ronald Raymond Biederman (Ph.D. Thesis) 1968 157 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-2098

The influence of deformation on nucleation and growth of carbides in deformed metastable austenite is revealed for AISI H-11 steel. Rapid strain induced carbide growth is observed to occur upon aging of austenite after the deformation process. Carbide growth is found to depend significantly on the amount of deformation, the deformation temperature and the aging conditions. Carbide nucleation occurs preferentially at regions of high strain energy, in particular, along slip-lines and in deformed austenite grain boundaries at high aging temperatures. When the steel is aged in the metastable austenitic bay region (700F – 1100F) the precipitation appears more uniform than that observed at the higher aging temperatures. The precipitating carbides are shown from electron diffraction analysis to have an M_7C_3 type structure. Deformation of austenite prior to isothermal decomposition eliminates the normal transformation product. Dissert. Abstr.

N69-40983# Battelle Memorial Inst., Columbus, Ohio.
FLAME STRAIGHTENING AND ITS EFFECT ON BASE METAL PROPERTIES Summary Report
H. E. Pattee, R. M. Evans, and R. E. Monroe Washington Coast Guard Aug. 1969 41 p refs
(Contract N00024-68-C-5324)
(AD-691555; SSC-198) Avail: CFSTI CSCL 11/6

The suitability of flame-straightening methods now used on conventional ship steels for the higher strength ship steels is questionable. The report discusses some of the potential problem areas that need evaluation to examine this subject. Based on a survey of pertinent literature it is shown that only limited data applicable to this subject are available. The data analysis covered the nature of distortion, flame-straightening techniques, and the effects of both single and combined thermal cycles and plastic strain cycles on material properties. An experimental program is presented that is designed to generate background data on conventional steels and several higher strength steels directly pertinent to flame straightening. These data will subsequently be evaluated to ascertain suitability of the flame-straightening procedure for various ship steels. Author (TAB)

N69-40991# Kresge-Hooker Science Library Services, Detroit, Mich.
INORGANIC CHEMISTRY: MICROGRAPHIC STRUCTURE OF OXIDE LAYERS FORMED DURING THE OXIDATION OF MASSIVE ZIRCONIUM
Jean Debuigne et al 23 Jul. 1969 5 p refs Transl. into ENGLISH from Compt. Rend., Ser. C (France), no. 266, 1968 p 903 – 905 Prepared for Bettis Atomic Power Lab. Sponsored by AEC
(WAPD-Trans-118) Avail: CFSTI

The fibrous structure of layers of zirconia formed by the oxidation of zirconium was studied as well as their behavior during the course of thermal treatments at high temperatures. Author (NSA)

N69-41015*# Hydronautics, Inc., Laurel, Md.
CAVITATION DAMAGE IN LIQUID METALS: POTASSIUM STUDIES Final Report
A. Thiruvengadam, S. L. Rudy, and H. S. Preiser Apr. 1968 75 p refs
(Contract NAS3-8506)
(NASA-CR-106481; TR-607) Avail: CFSTI CSCL 11F

Studies on the relative cavitation damage resistance in high purity liquid prtassium of five candidate materials for use in high output, Rankine-cycle space power systems are presented. Results of tests on TZC, Cb-132M, TiC + 10% Cb binder, 316 stainless steel and T-111 are given. The effects on damage resistance

of liquid potassium temperature (up to about 1200°F) and argon pressure above the liquid potassium surface, are described. Of the metals tested TiC + 10% Cb is found to exhibit the best erosion resistance up to about 900°F. The rate of erosion is significantly dependent on both the temperature and the argon pressure. It may be stated that in general, the rate of damage increases with temperature and then decreases, and also that the rate of damage is small at sub-atmospheric pressures. Author

N69-41054# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Laboratorio Tecnografico.
DETERMINATION OF THE SELF-SHIELDING PROPERTIES OF GADOLINIUM IN ALUMINA AND NATURAL URANIUM DIOXIDE MATRICES
B. Arcipiani. 26 Feb. 1969. 38 p. refs.
(RT/FI/69/20) Avail: CFSTI

Pellets pressed and sintered from homogeneous mixtures of Al_2O_3 or natural UO_2 powders with Gd_2O_3 grains, placed in small aluminum cylindrical containers were investigated for self-shielding properties. The net normalized signal of each sample with the same matrix material was considered to be proportional to the total absorption cross-section of the gadolinium atoms present in the sample reduced by the microscopic and macroscopic self-shielding factors of the poison. A series of equations is constructed and expanded to express the net normalized signal measured for each sample. R.B.

N69-41059# NERATOOM, N. V., The Hague (Netherlands).
STAINLESS PLATING OF HEAVY-GAUGE STEELS Final Report
31 May 1968. 74 p. refs. Transl. into ENGLISH from French Report. Sponsored by AEC and EURATOM. Prepared for AEC and EURATOM.
(Contract EURATOM-008-63-12-TEEB (RD))
(EURAEC-2093) Avail: CFSTI

The superiority of the strip process with regards to other plating processes was confirmed. The simplicity of the equipment makes it useful and safe. The depositing speeds are high and there are but very few risks of fault and crack formations in the deposits. It is possible to plate parts having a complicated profile. Among the stainless steel compositions which can be deposited the types ASTM 308 L, 316 L, 316 L with low ferrite content, 347, and 318 may be cited. This enumeration is by no means limiting. By means of this process it is also possible to deposit, among others, pure nickel, various nickel alloys, and cupro-nickels. NSA

N69-41061*# AiResearch Mfg. Co., Los Angeles, Calif.
BRAZE ALLOY INVESTIGATION
L. F. Jilly, ed. 27 May 1969. 11 p.
(Contract NAS1-6666)
(NASA-CR-66845, AP-68-3813) Avail: CFSTI; CSCL 11F

A new braze alloy, designated Palniro RE, was developed especially for use on the Hypersonic Research Engine. The braze alloy composition is 55 w/o gold, 30 w/o nickel, 15 w/o palladium; it has a nominal braze temperature of 2025 degrees F. The evaluation of this braze alloy provided data on melting temperature, wettability and filleting, alloying and intergranular penetration with Palniro 1, remelt and diffusion with Palniro 1 and Palniro 4, and creep rupture strength when used for brazing of plate-fin flat panels. In addition, an evaluation was made of the creep rupture strength of Palniro 1. The creep rupture tests show the Palniro RE to be weaker than Palniro 1 or Palniro 4. Palniro RE is not suitable for use in brazing plate-fin shells that operate at the highest engine temperature; however, it is suitable for use in brazing the manifolds to the shell structures. Author

N69-41067# Brookhaven National Lab., Upton, N.Y.
HIGH-TEMPERATURE LIQUID-METAL TECHNOLOGY REVIEW, VOLUME 7, NO. 1 Bimonthly Technical Progress Review
Feb. 1969. 46 p. refs.
(BNL-50170) Avail: CFSTI

A review is presented of high-temperature liquid metal technology that includes information on the physical properties and thermodynamics, fluid dynamics, heat transfer, corrosion and erosion, instrumentation, component development, chemistry, fabrication, and safety. NSA

N69-41068# California Univ., La Jolla.
NEW MATERIALS BY LOW-TEMPERATURE CONDENSATION Progress Report
Huey-Lin Luo. 15 Feb. 1969. 25 p. refs.
(Contract AT(11-1)-34)
(UCSD-34-P-162-11) Avail: CFSTI

Activities in a program devoted to preparation and measurements of $Nb_3(Al_{0.75}\ Ge_{0.25})$ intermetallic compounds are summarized. Efforts were devoted to determining the sputtering yield of pure Nb and preparation of Nb–Al alloys by sputtering. Data on Nb–Al films produced by sputtering are included. NSA

N69-41073# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
HIGH-DENSITY TUNGSTEN SPHERES
J. H. Nash, A. C. Neeley, and P. J. Steger. 18 Nov. 1968. 20 p. refs.
(Contract W-7405-eng-26)
(Y-1654) Avail: CFSTI

Two four-inch-diameter, unalloyed tungsten spheres were machined and lapped to a sphericity of better than five micro-inches and a background surface finish of less than three micro-inches, peak to valley. The material used was a special, uniform-density, gas-pressure-bonded tungsten made specially for the job. Author (NSA)

N69-41090# Brookhaven National Lab., Upton, N.Y.
HIGH-TEMPERATURE LIQUID-METAL TECHNOLOGY REVIEW, VOLUME 6, NO. 4 Bimonthly Technical Progress Report
Aug. 1968. 31 p. refs.
(BNL-50137, PR-34) Avail: CFSTI

Eleven reviews are presented of current topical and progress reports in the field of high-temperature liquid-metal technology. The reviews cover: materials development, corrosion and mass transfer, heat transfer, fluid dynamics, instrumentation purification, component development, physical properties, thermodynamics, chemical analysis, and power systems. The reports reviewed are from research programs for the devedopment of fast breeder reactors and power systems for space vehicles. NSA

N69-41160# Oak Ridge National Lab., Tenn.
LOW-TEMPERATURE DUCTILITY AND HYDROGEN EMBRITTLEMENT OF URANIUM
H. Inouye and A. C. Schaffhauser. Jul. 1969. 41 p. refs.
(Contract W-7405-eng-26)
(ORNL-TM-2563) Avail: CFSTI

The ductile-to-brittle transition temperature of uranium, which ranges between 100° and −50°C, is influenced by the grain size, strain rate, and the grain structure. The ductility of uranium at room temperature depends upon the heat treatment, fabrication procedures, and the testing conditions. Aluminum, silicon, and carbon impurities in concentrations below 1000 ppM impair the ductility. A literature review of the hydrogen embrittlement of uranium was made. Threshold concentrations between 0.2 and 0.5 ppM H present as β-UH_3 are the probable causes of the severe impairment of the ductility at room temperature. The morphology of UH_3 and microcracks associated with this phase also influence the degree of embrittlement. The hydrogen in heat-treated uranium is derived from the reaction of uranium with water vapor in the annealing media. Author (NSA)

N69-41161# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.

CREEP-RUPTURE DATA FOR THE REFRACTORY METALS TO HIGH TEMPERATURES

J. B. Conway and P. N. Flagella. Mar. 1969. 986 p. refs.
(Contract AT(40-1)-2847)
(GEMP-685; R-69-NSP-9) Avail: CFSTI

A comprehensive compilation of creep-rupture data for the refractory metals to 3000°C is presented. Chapters are included on tugnsten, rhenium, tantalum, molybdenum, and niobium, as well as the alloys of the metals. A chapter is devoted to the mathematical techniques useful in the analysis of creep data, a chapter is devoted to parametric correlations of stress-rupture data, and a chapter is devoted to experimental procedures pertinent to the measurement of the creep-rupture behavior of refractory metals at elevated temperatures. Special attention was given to the data accumulated over the past seven years in the AEC-sponsored refractory metal evaluation program conducted. Author (NSA)

N69-41202 California Inst. of Tech., Pasadena
THE MOBILITY OF DISLOCATIONS IN HIGH PURITY ALUMINUM

Jeffrey Archibald Gorman (Ph. D. Thesis). 1968. 106 p.
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00. Order No. 69-506

This thesis presents the results of measurements of the velocities of edge and mixed dislocations in aluminum as a function of temperature and applied shear stress. All tests were conducted on 99.999% purity aluminum single crystals. Dislocation velocities were determined by observing the positions of dislocations by the Berg-Barrett X-ray technique before and after applying a stress pulse. Torsion stress pulses of microsecond duration were applied by propagating torsional waves along the axes of cylindrical crystals. Resolved shear stress up to 16 × 10^6 dynes/cm^2 were applied at temperatures from -150°C to 70°C. Measured dislocation velocities ranged from 10 to 2750 cm/sec. The results of this study indicate that the velocity of edge and mixed dislocations is linearly proportional to the applied resolved shear stress in the temperature range studied. Dislocation velocity increases as temperature is decreased. Dissert. Abstr.

N69-41247*# General Technologies Corp., Reston, Va.
CRITICAL ANALYSIS OF ACCUMULATED EXPERIMENTAL DATA ON FILAMENT-REINFORCED METAL MATRIX COMPOSITES

John A. Alexander, Robert G. Shaver, and James C. Withers. Jun. 1969. 145 p. refs.
(Contract NASw-1779)
(NASA-CR-106490) Avail: CFSTI CSCL 11F

A critical review is presented of the experimental accomplishments in the field of filament reinforced metal matrix composites. The review covers the experimental work reported in the period 1965 through 1968. It treats the fabrication processes which have been employed to produce a variety of composite forms in terms of the processing parameters which determine ultimate properties. The mechanical property data have been treated in a manner which emphasizes the character of metal matrix composite performance rather than the absolute values of the specimens tested. Finally the review underlines the residual problem areas and suggests experimental approaches to the advancement of composite technology. Author

N69-41270# Dow Chemical Co., Golden, Colo.
ROLLING TEXTURE OF SOME PLUTONIUM GALLIUM ALLOYS

Joseph E. Schindler. 12 May 1969. 7 p. refs.
(Contract AT(29-1)-1106)
(CRFP-1315) Avail: CFSTI

The rolling textures of Pu-0.75 wt % Ga and Pu-1.0 wt % Ga alloys were studied as a function of rolling reduction through the use of pole figures. The samples were cold-rolled to 70%, 80%, 90%, or 95% reduction. The texture of the alloys was found to be very close to that of cold-rolled copper at high reductions. Author (NSA)

N69-41299# Union Carbide Corp., Oak Ridge, Tenn.
CONCERNING PROBLEM IN ADAPTIVELY CONTROLLED METAL CUTTING

K. G. Kahl. 28 Oct. 1968. 121 p. refs.
(Contract W-7405-eng-26)
(Y-1630) Avail: CFSTI

A survey of adaptive control for metal cutting is presented, and a parameter adjustment model using fixed-increment sequential parameter adjustments and switching boundaries is developed. The adjustment model, used in conjunction with an adaptive control system, is used to solve a cornering problem encountered in numerically controlled metal cutting. A computer program is used to statically test the adjustment model in a variety of simulated conditions. Author (NSA)

N69-41318# Naval Research Lab., Washington, D.C.
COMPUTER-PLOTTED STEROGRAPHIC PROJECTIONS

E. A. Metzbower. 7 Jul. 1969. 49 p. refs.
(AD-691769; NRL-6919) Avail: CFSTI CSCL 20/2

Stereographic projections for materials having hexagonal symmetry depend on the axial c/a ratio. Thus, each material requires its individual set of stereographic projections. The facilities of the NRL Research Computation Center have been used to calculate and plot standard stereographic projections for seven hexagonal close-packed metals with different axial c/a ratios. The stereographic projections and the computer program are included in the report. Author (TAB)

N69-41319# Commissariat a l'Energie Atomique, Paris (France).
NICKEL COATING BY DECOMPOSITION OF NICKEL CARBONYL ON PLUTONIUM ALLOYS

J. Auvity, J. C. Beaumont, E. Fain, A. de Fouchier, J. C. Lecocq et al. [1968] 20 p. ref. In FRENCH. Presented at the Intern. Conf. on Appl. of Vacuum Sci. and Tech. to Coating and Surface Finishing, Dijon, France.
(CEA-CONF-1241; CONF-681048-1) Avail: AEC Depository Libraries

Coating of plutonium alloys with Ni by the endothermal decomposition of nickel carbonyl by the Owen process was studied. The deposition conditions were described. The particular case of Pu alloys was considered. The results obtained show that the structure of the coatings depends on the decomposition temperature. The method was applied to the coating of Pu alloys of relatively large dimensions. NSA

N69-41323 Washington Univ., Seattle
FERROMAGNETIC RESONANCE AND SPIN-DIFFUSION IN THE FERROMAGNETIC METALS

Robert Lambert Cooper (Ph.D. Thesis). 1968. 149 p.
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00. Order No. 69-1158)

Ferromagnetic resonance in metals was investigated in an attempt to identify the mechanism responsible for relaxation at microwave frequencies. The absorption and dispersion modes at 9.17 GHz were studied in thin disks of Supermalloy at 25°C as a function of the angle between the static magnetic field and the sample surface. The observed lineshapes were compared with predictions for several relaxation processes and boundary conditions. The experimental equipment and procedure are described. The calibration of a microwave reflectometer and the conversion of data into surface impedance are discussed. The effects of strain, surface roughness, heat treatment, surface oxidation and reduction, chemical-polishing, and electropolishing are considered. Results are presented in the form of complex impedance diagrams. Comparisons with the phenomenological theory are shown for parameters determined by means of a least squares fit. Dissert. Abstr.

N69-41346# Kernforschungszentrum, Karlsruhe (West Germany).
INNER OXIDATION AS A CORROSION PHENOMENA OF LIQUID SODIUM WITH SMALL SODIUM OXIDE CONTENT
H. U. Borgstedt and G. Frees. Dec. 1968 17 p refs In GERMAN
(KFK-879; EUR-4159) Avail: AEC Depository Libraries

In the corrosion of titanium-containing vanadium alloys in liquid sodium with oxide concentration below 10 p.p.m. in the temperature range 500° to 600°C, embrittlement phenomena in the metal phase were observed as a result of the penetration of oxygen. Thermochemical hypotheses were given for the internal oxidation of vanadium – titanium alloys in flowing sodium. The penetration of the oxygen into the alloy is consistent with the phenomenon of internal oxidation. Ideas for future alloy development were obtained from the experimental data. Author (NSA)

N69-41349# Bureau of Mines, Washington, D.C.
EXPERIMENTAL LEACHING OF GOLD FROM MINE WASTE
H. J. Heinen and Bernard Porter. Apr. 1969 90 p refs
(PB-183457; RI-7250) Avail: CFSTI CSCL 20H

Excellent gold recovery was demonstrated in a laboratory-scale leaching test on waste material from an open-pit mine in northeastern Nevada. An injection system of leaching was applied in which the sodium cyanide solution was introduced into the interior of the dump at selected points. Dissolution of gold from the waste material, which assayed 0.06 ounce gold per ton, was readily achieved because the gold occurred as submicroscopic particles in a porous host rock. Gold recovery of 80 percent was obtained in 11 days from material crushed to 1 inch in size, and recovery was 90 percent after 21 days. Author (USGRDR)

N69-41356 California Univ., San Diego.
SPIN WAVES IN THE ALKALI METALS
Gerald LeRoy Dunifer (Ph.D. Thesis) 1968 177 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-1706

Results of a study on some of the electronic properties of sodium and potassium metals at microwave frequencies are presented. The main emphasis is given to the study of spin waves, a collective excitation of the conduction electrons due to their mutual interaction. A detailed study of their behavior allows us to extract for sodium the first three Legendre coefficients of the spin dependent part of the Landau interaction function. The first two coefficients were determined for potassium. From a study of the zero-wavevector spin wave, the g-value for the conduction electrons in sodium and potassium was determined to within an uncertainty of ± 0.00005. A discussion is included on the transmission technique of microwave spectroscopy which can be used whenever the samples are thin metallic films. Also described are other modes of the system resulting from the orbital motion of the conduction electron which can be excited and detected when using the transmission technique. Some of these offer the possibility of more accurate measurements on the effective mass of the conduction electrons, and a determination of the spin independent part of the Landau interaction function. Dissert. Abstr.

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N69-40041# Duke Univ., Durham, N.C.
STATISTICAL THERMODYNAMICS OF BULK POLYMERS Final Report, 1 Sep. 1961 – Feb. 1968
William R. Krigbaum. 2 Jul. 1969 8 p refs
(Grant DA-ARO-D-31-124-G202; DA-ARO-D-31-124-G580)
(AD-690870; Rept-3222.12-C) Avail: CFSTI CSCL 11/10

An investigation of the mechanical properties of bulk polymers in the crystalline and amorphous states is described. The study involved application of statistical mechanics to appropriate models. Author (TAB)

N69-40050# Fabric Research Labs., Inc., Dedham, Mass.
BIAXIAL TENSILE TESTS OF COATED FABRICS
R. E. Sebring, M. M. Schoppee, and W. D. Freeston. May 1969 34 p
(Contract DA-19-129-AMC-1042(N))
(AD-690840; TR-69-75-GP) Avail: CFSTI CSCL 11/5

This report discusses the design, operation, and purpose of a new biaxial tensile test instrument to measure the stress-strain behavior of fabrics. The report also presents the stress-strain test results on three air-supported tent fabrics performed with the new test instrument. A correlation and comparison is made between these data and previous work performed with other tensile test equipment. Author (TAB)

N69-40108# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIS OF HEAT-RESISTANT POLYMERS CONTAINING A SYMMETRICAL TRIAZINE CYCLE
Yu. A. Muravyev et al. 4 Jun. 1968 11 p refs Transl. into ENGLISH from Soobshch. Akad. Nauk Gruz. (Tiflis), v. 46, no. 2, 1967 p 353 – 358
(AD-692155; FTD-HT-23-331-68) Avail: CFSTI CSCL 11/9

The method of high-temperature polycondensation was used to obtain a whole series of polyphenylene-sym-triazinyl esters on the basis of cyanuric chloride, its aryl-amino substitute, and bis-phenols. It was found that the basic process of polycondensation of arylamino substitutes of cyanuric chloride with bisphenols is accompanied by a side reaction of homocondensation of the aryl-amino substitutes of the cyanuric chloride. Some properties of the synthesized polyphenylene-sym-triazinyl esters are described. Low-molecular polymers were synthesized by homocondensation of 2-phenyl-amino-4,6-dichloro-1,3,5-triazine and 2-phenylamine-4,6-dichloro-1,3,5-trizine. Polyphenylene-sym-triazinyl esters found practical use as hardeners of epoxy resins. Author (TAB)

N69-40118# British Aircraft Corp. (Operating) Ltd., Bristol (England). Guided Weapons Div.
MATERIALS FOR SPACE APPLICATION
P. N. Cornall. 1969 8 p Presented at the 3d Brit. Interplanet. Soc. Symp. on Mater. in Space Technol., Bristol, Engl., 9 – 11 Apr. 1969
Avail: CFSTI

Many dissertations have been made on the use of materials in the space environment. Studies are currently being made on the newer materials such as carbon fibers and certain special coatings. A summary of the uses of materials in spacecraft is presented, and concludes that the majority of those in aeronautical engineering are suitable; with the notable exceptions of cadmium, zinc, natural rubbers and conventional lubricants. Author (ESRO)

N69-40165# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF PROTECTIVE COATINGS ON THE STRENGTH PROPERTIES OF CAST STEELS
Ye. A. Antonova et al. 2 Jun. 1969 9 p refs Transl. into ENGLISH from Tr. Temperaturoustoy Chivyye Zashchitn. Pokrytiya (Leningrad), 1968 p 262 – 267 Presented at Seminar on Heat-Resistant Coatings, Leningrad, 1966
(AD-692357; FTD-HT-23-161-69) Avail: CFSTI CSCL 11/3

Prolonged operation of the turbine rotor of a supercharged diesel normally results in a decrease in the strength characteristics of its material and premature fracture of its blades. Hence, the application of high-temperature coatings to the turbine rotor should be an effective method of enhancing the reliability and life of the strength characteristics of cast steels EI572L (austenitic) and EI415

(pearlitic), used as the materials for integrally cast turbocompressor rotors, was investigated. The following coatings were tested: (a) 1 M metalloid coating (20 wt. percent Cr, 70 wt. percent Ni, 5 wt. percent B, 5 wt. percent Si), (b) SM-418 glass-metal coatings representing a combination (1 to 1 weight ratio) of A-418 barium silicate glass with a mixture of fine disperse powders of Cr, Ni, B and Si of the aforementioned composition, (c) a Ni-P coating deposited by the chemical nickel plating method from an acid solution. The metalloid and glass-metal coatings were applied by the enameling method in the form of slip applied to the cleaned surface of steel specimens which then were dried and fired (at 1040 - 1100 degrees C) for 1 M and 1200 - 1260 degrees C for Sm-418). Their thickness ranged from 200 to 300 Mu.

Author (TAB)

N69-40192# Watervliet Arsenal, N.Y. Benet R and E Labs.
ON THERMAL CONDUCTIVITY OF COMPOSITES
Ginlano D'Andrea (Ph.D. Thesis - - Rensselaer Polytech. Inst.) May 1969 51 p refs
(AD-691330; WVT-6915) Avail: CFSTI CSCL 11/4

Thermal conductivity of composites, made of highly conductive metal fibres randomly distributed in low conductive matrices, is investigated experimentally as well as theoretically. Experimental results are presented for a factorial experiment consisting of five factors at two levels. The factors are the length of the fibre, the cross section of the fibre, the thermal conductivity of the fibre, the thermal conductivity of the matrix, and the fibre volume ratio. It is shown that the most meaningful factors to be considered for an optimum design of the type of composites in question are, in the order of importance, the conductivity of the matrix, the fibre volume ratio, and the fibre cross section. Earlier theoretical efforts consisted of mathematical models which are highly idealized, e.g. square lattices, face centered cubic models (Maxwell, Rayleigh, Bruggeman). The model used in this investigation is that of a matrix filled with fibres ellipsoidal in shape and randomly distributed, according to prescribed fibre volume ratios. It is a stochastic model. An expression of the conductivity of this composite is derived and results are obtained with the aid of a high-speed computer. Theoretical prediction of the stochastic model checks with experimental data. Also it shows that additional factors are involved in describing composites which are not covered by earlier theories. These factors are fibre geometry and its distribution. Moreover, a specific specimen formulation gives a thermal conductivity similar to that of stainless steels but a density only a quarter of that of the steel. Author (TAB)

N69-40272# IIT Research Inst., Chicago, Ill. Mechanics of Materials Research Div.
FEASIBILITY OF JOINING ADVANCED COMPOSITE FLIGHT VEHICLE STRUCTURES
D. Kutscha and K. E. Hofer, Jr. Jan. 1969 492 p refs
(Contract AF 33(615)-3962)
(AD-690616; AFML-TR-68-391) Avail: CFSTI CSCL 11/4

A combined analytical-experimental study was carried out to establish the feasibility of developing rational design techniques for bonded and mechanical joints in advanced composite structures. Available stress analyses were compared for their predictions of maximum stresses in joints and these results were compared to experimental data. The static strengths were measured for three adhesives bonded to fiberglass, steel, and titanium, and the fatigue strengths were measured for the optimum joint designs. The load distribution and joint strength was studied for fiberglass bolted joints. Recommendations were made for specific additional work required both in joints analysis and characterization of materials. Author (TAB)

N69-40295 National Lending Library for Science and Technology, Boston Spa (England).
BET MEASUREMENTS OF TITANIUM DIOXIDE PIGMENTS
H. Rechmann [1969] 15 p refs Transl. into ENGLISH from Farbe Lack (Hanover), v. 75, 1969 p 51 - 57
(NLL-M-7666-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

The specific surface of untreated titanium dioxide pigments as a rule increases with progressing comminution and decreases with increasing temperature of calcination. In treated titanium dioxide pigments it depends greatly upon the conditions of treatment; for example it is larger after wet processing than after dry processing, and after neutralization with ammonia instead of soda, and when a particular amount of treating agent is used in one and not two stages. The dependence of specific surface upon the kind and amount of treatment agent was also investigated. All the above indicated parameters alter the BET surface though the distribution of particle size of the pigment does not change. Thus BET measurements of treated titanium dioxide pigments give no indication of grain size distribution, which is very important for many properties of the pigment. Author

N69-40298# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FIBROUS HEAT-RESISTANT MATERIALS
L. I. Bobrov 23 Jun. 1969 18 p refs Transl. into ENGLISH from Russian publ. Kritika i Bibliografiya
(AD-691871; FTD-MT-24-25-69) Avail: CFSTI CSCL 11/5

A brief survey of the history and development of refractory materials based on metallic, ceramic, graphite, carbon, impregnated synthetics, and organically coated fibers. Comparative data on the properties of various materials and fabrics is given. Author (TAB)

N69-40339*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRANSMISSION EFFECTS ON PLASTIC FILMS IRRADIATED WITH ULTRAVIOLET LIGHT, ELECTRONS, AND PROTONS
Evelyn Anagnostou and Adolph E. Spakowski Washington Oct. 1969 12 p refs
(NASA-TM-X-1905) Avail: CFSTI CSCL 11C

Several plastic films, suitable as covers for thin film CdS solar cells, were irradiated by ultraviolet light in vacuum. The films were bombarded by 1-MeV electrons at fluences up to 1×10^{17} electrons/cm^2, and one of the films was bombarded by 800-keV protons at fluences up to 1×10^{14} protons/cm^2. The effect of these environments on the transmission of the plastics in the wavelength range 0.350 to 1.200 μm was measured. The most promising cover material was Teflon -FEP. Author

N69-40400# Rensselaer Polytechnic Inst., Troy, N.Y.
CREEP IN FLAKE COMPOSITES Final Report, 1 Feb. 1966 - 31 Jan. 1969
Maurice B. Bayly May 1969 64 p refs
(Contract DA-31-124-ARO(D)-411)
(AD-690860; AROD-5041.1-E) Avail: CFSTI CSCL 11/4

The project had three objectives: (1) to generate deformable flake composites in which the flakes are all parallel; (2) to study the relation between the concentration of flakes and the properties of the composite, in particular its viscosity and anisotropy, in plane strain; (3) to study the buckling of laminar assemblies in which flake composites form alternate laminae, to see the effect of the composites mechanical properties on the buckling geometry that results. Author (TAB)

N69-40413# Kansas State Univ., Manhattan. Nuclear Engineering Dept.
MEASUREMENT OF ANGULAR AND ENERGY SPECTRA OF WALL TRANSMITTED RADIATION Final Report
R. E. Faw, R. M. Rubin, J. M. Royer, and M. J. Coolbaugh 31 Jan. 1969 183 p refs
(Contract NO022867C2999)
(AD-691848; NRDL-TRC-69-10; KEES-SR-12) Avail: CFSTI CSCL 11/4

The energy and angular spectra of gamma radiation penetrating a 48 plus or minus 1 psf vertical slab bounding a simulated

semi-infinite plane radiation source were measured. The experimental results are given in terms of gamma-ray flux differential with respect to energy and direction, normalized to a 60Co source strength of 1 Ci/sq ft. The measurements were made at a height 3 feet above grade at each of 40 directions. Author (TAB)

N69-40488# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
STRAIN-SENSITIVE RESPONSE OF FILLED ELASTOMERS
Alfred M. Freudenthal Dec. 1968 40 p refs
(Contract Nonr-266(78))
(AD-691875; TR-42) Avail: CFSTI CSCL 11/10

The strain-dependence of the elastic and the anelastic behavior of filled elastomers is discussed in the light of recent experiments on carbon-black filled rubber as well as on sodium-chloride filled polyurethane. The latter experiments suggest that the apparent creep of filled elastomers is the manifestation of the gradual change of the elastic moduli resulting from the loss with strain of effective filler-matrix interaction, rather than a truly visco-elastic phenomenon. Author (TAB)

N69-40507# Esso Research and Engineering Co., Linden, N.J. Government Research Lab.
GLASS FIBER CORD AIRCRAFT TIRE Final Report, 2 Jun. 1964 - 12 Dec. 1967
Robert E. Clayton 21 Mar. 1969 63 p
(Contract AF 33(657)-12902)
(AD-691857; GR-1-GCT-68; ASD-TR-68-63) Avail: CFSTI CSCL 11/2

The overall objective of this effort was to develop the techniques necessary to construct aircraft tires using glass fiber cord as a basic tire structural material. The tires were counterpart to Type VII, M-T.T. 34 X 9.9, which is an extra high pressure tire. The project tires were of radial ply design with glass fiber cord in both the carcass and belt plies. In order to protect the glass cord filaments from interfilament chafing and to provide for bonding the tire rubber to the cord, the glass filaments were specially sized and coated with elastomer composition before the cords were formed. The work program of the contract was divided into four phases: glass cord design work on a laboratory test scale, glass cord development on a laboratory and fire test scale, prototype tire construction and static tire tests, and dynamic tire tests. Author (TAB)

N69-40680# IIT Research Inst., Chicago, Ill.
FABRICATION AND CHARACTERIZATION OF METAL CARBIDE-GRAPHITE COMPOSITES
Y. Harada, S. A. Bortz, and S. L. Blum In Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 2 1968 44 p refs (See N69-40674 24-17)
Avail: CFSTI

Refractory metal carbide-graphite composites were prepared by hot pressing at 2600° to 3200°C. The effect of variations in composition and processing on flexural, tensile and compressive strengths; thermal expansion and conductivity,high temperature deformation, and electrical resistivity were determined, both parallel and perpendicular to the hot pressing direction. The NbC-C and TaC-C systems were principally studied while other systems such as TiC-C, ZrC-C, HfC-C, VC-C, $MoC_{(1-x)}$-C and WC-C were also investigated. TaC-C composites displayed the highest elevated temperature strength and resistance to plastic deformation. Composites containing 80 vol% TaC displayed flexural strengths of over 20,000 psi in both grain directions up to 2500°C, superior to that for any commercial graphite or pure TaC. It was also determined that with increasing carbide content, higher strength, decreasing anisotropy, decreasing resistance to high temperature deformation and decreasing electrical resistivity occur. Author

N69-40695# Radio Corp. of America, Harrison, N.J. Electronic Components.
APPLICATION OF REFRACTORY MATERIALS AS DIFFUSION BARRIERS
P. J. Chao *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 3 1968 14 p refs (See N69-40692 24-17)
Avail: CFSTI

Preliminary evaluation of the effectiveness of chromium silicon alloy coatings on Hasteloy B as diffusion barriers to gold indicates that this alloy is very promising for future experimentation. Because phases existing in the chromium silicon alloy coating have not been completely identified, it is not possible to attribute the barrier function to any of such phases. Author

N69-40701# TRW Equipment Labs., Cleveland, Ohio.
CORROSION RESISTANT COATINGS FOR REFRACTORY METALS AND SUPERALLOYS
J. D. Gad *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 3 1968 51 p refs (See N69-40692 24-17)
Avail: CFSTI

A review is presented of the development and evaluation of coatings for the protection of columbium, nickel and cobalt base alloys in aircraft gas turbine applications. A vacuum pack method is described for the formation of Cr-Ti-Si coatings on columbium alloys. Analogous processing sequences are described for the formation of modified aluminide coatings on nickel and cobalt base super-alloys. Evaluation of the coated alloys involved exposure in air, and in a simulated aircraft gas turbine environment. Visual examination, weight change analysis, metallographic examination and electron microprobe analysis were utilized to evaluate coating protection and degradation. Diffusional behavior and phase formation during coating application and subsequent corrosion testing are discussed for the various coating-base metal systems. Models are presented which describe the general coating formation and degradation processes characteristic of the various composites. Author

N69-40741*# Northrop Corporate Labs., Hawthorne, Calif.
STUDY OF DOPANTS FOR RADIATION-RESISTANT SILICON Quarterly Report
Oct. 1969 16 p Prepared for JPL
(Contracts NAS7-100; JPL-952523)
(NASA-CR-106381; NCL-69-52R) Avail: CFSTI CSCL 11D

A number of lifetime samples were prepared and characterized using the existing supply of Al- and B-doped material. Highly uniform samples were prepared by diffusing lithium into blanks made of ≈160 ohm cm P-doped material, to be used to evaluate further the effect of lithium on the radiation response of silicon. In addition, four Al-doped crystals representing different dopant concentrations (5 and 10 ohm cm) and different crystal growth techniques (Czochralski and float-zone) have been ordered from each of two different suppliers for a detailed study of the effect of this impurity on lifetime degradation in bulk silicon. Author

N69-40746# Directorate of Scientific Information Services, Ottawa (Ontario).
STONE IN PLACE OF METAL
G. M. Davydov Jun. 1969 6 p ref Transl. into ENGLISH from Priroda (Moscow), No. 6, 1968 p 80-82
(AD-691293; T-506-R) Avail: CFSTI CSCL 13/8

During the last three decades there has been developing a new science of petrurgy, a science that is connected with the mineralogy, petrography and the physical chemistry of a natural raw material; and with the properties of castings made from that raw material. Author (TAB)

N69-40758# Technishe Hochschule Munchen (West Germany). Fakultaet Fuer Maschinenwesen Und Elektrotechnik.
THE IMPULSE BREAKDOWN IN INSULATING OIL [DER STOSSDURCHSCHLAG IN ISIOLIEROEL]
In GERMAN
Avail: CFSTI

Standing and breakdown impulse voltages were measured

and graphically recorded, and discharges were optically evaluated, to improve empirical data and to establish formulas for the insulating properties of oils. The experiments were conducted with two impulse generators, one of which was a conventional 3-MV type for producing impulse voltages of high amplitude, the other an 800-kV steep-impulse type for producing impusle voltages with the shortest-possible front time. Discharges were recorded with an image converter camera having a time resolution down to 10 nsec. All measurements were made on rotation-symmetric electrode arrangements, and especially on rod-rod and rod-plate configurations whose interval was varied from 2.5 to 200 mm. Field strengths on the electrodes were measured and computed, taking surface damages into account. The voltage stability of an insulating oil was found to depend strongly on the field strength of the high-voltage electrodes; and the field strength in turn was found to be strongly influenced by the curvature radius of the electrodes. Transl. by K.W.

N69-40848# Radio Corp. of America, Harrison, N.J.
SILICON GERMANIUM THERMOELECTRIC MATERIALS AND MODULE DEVELOPMENT PROGRAM Quarterly Report, 1 Jan. 1969 - 31 Mar. 1969
1969 114 p
(Contract AT(29-2)-2510)
(ALO-2510-5; QR-5) Avail: CFSTI

Operation of a drop calorimeter facility to measure specific heat of silicon systems was initiated during the period. Progress is also reported on establishment of a capability to coat graphite hot shoes with Si to allow for air operation. Selection of 80 to 83% Si-content SiGe for further examination is reported. Operation of thermoelectric converters at high temperatures during the period is discussed. Efforts devoted to parametric analyses of SiGe hot stage using a computer are summarized. NSA

N69-40878# Technische Hochschule Munchen (West Germany).
THE LAOLIN DEPOSITS OF TIRSCHENREUTH AND THEIR GEOLOGICAL BACKGROUND COMPARED WITH THE WEIHERHAMMER DEPOSITS [DIE KAOLINLAGERSTAETTEN VON TIRSCHENREUTH UND IHR GEOLOGISCHER RAHMEN IN VERGLEICH ZU DEN LAGERSTAETTEN VON WEIHERHAMMER]
Otto Strobel (Ph.D. Thesis) 1969 32 p refs In GERMAN
Avail: CFSTI

Petrographic, tektonic, and deposit side studies were performed on kaolinite samples from two areas in order to determine their mineralogical compositions and formation histories. Results indicated that primarily pneumatolytical-hydrothermal developments and their typical reaction sequences changed certain granite formations into definite quartz-feldspar-kaolinite deposits at the Tirschenreuth location. Deposits at the Weiherhammer location on the other hand seem to have been developed from granite or porphyric formations into kaolinites through effects of a strongly oscillating ground water level. Transl. by G.G.

N69-40918# Brookhaven National Lab., Upton, N.Y.
USE OF SEALS AS A SAFEGUARDS TOOL
Cesar A. Sastre 6 Mar. 1969 19 p refs Sponsored by AEC
(BNL-13480) Avail: CFSTI

The security seal concept, functions and limitations of sealing systems, use of seals, and a comparison of seals with other security devices are presented. Also, types of security seals which are commercially available are described. Author (NSA)

N69-40930# National Bureau of Standards, Washington, D.C.
STANDARD REFERENCE MATERIALS: CATALOG AND PRICE LIST OF STANDARD MATERIALS ISSUED BY THE NATIONAL BUREAU OF STANDARDS
Jul. 1969 48 p Supersedes NBS Misc. Publ. 260 - 1968
(NBS-SPEC-PUBL-260) Avail: SOD $0.50

This catalog describes the various Standard Reference Materials issued by the National Bureau of Standards. These materials are used to calibrate measurement systems and provide scientific information that can be referred to a common base. A schedule of prices and quantities is included for each material, as well as directions for ordering. Listed are the types and compositions of those chemical standards that are presently available. Announcements of new standard reference materials are made in the Federal Register, in scientific and trade journals, and in the Technical News Builetin of the National Bureau of Standards. Changes affecting the current status of the various standards will be indicated by an insert sheet available quarterly from the Bureau. Author

N69-40933*# Aerojet-General Corp., El Monte, Calif.
COATINGS FOR ADVANCED THRUST CHAMBERS Final Report
W. J. Lewis [1968] 105 p refs
(Contract NAS3-11185)
(NASA-CR-72604) Avail: CFSTI CSCL 11C

Three coating concepts were evaluated in this program. They are: (1) the conventional concept of plasma arc spraying the thermal barrier on the ID surface of a conventionally fabricated thrust chamber; (2) the single tube concept in which the coating is plasma-arc sprayed on the crown of individual tubes and then the coated tubes are fabricated into a thrust chamber; and (3) the tile concept in which thermal barrier tiles are fabricated, setup on a mandrel and a thrust chamber is electroformed on the thermal barrier. A thermal analysis and a stress analysis were made on the single tube coating and the conventional coating concepts. The thermal analysis showed that the thermal barrier is only required on the crown of the tube and not in the valleys between the tubes and that a slot, 0.010 inch wide, extending longitudinally along the valley between tubes, could be tolerated. Therefore, the single tube coating concept is realistic from a thermal standpoint. The stress analysis showed that the maximum stresses in the coating in the single tube concept was 21,560 compared to 30,560 psi in the coating of the conventional coating concept. Therefore, the single tube coating concept is realistic from both the stress and thermal standpoints. Author

N69-40985# Aberdeen Research and Development Center, Aberdeen Proving Ground, Md. Coating and Chemical Lab.
SYNTHESIS AND STUDY OF MALATES AS LOW-HYGROSCOPIC BRAKE FLUID COMPONENTS Interim Report
Allan R. Brause and David W. Lipp Jul. 1969 11 p refs
(AD-691334; CCL-262; IR-1) Avail: CFSTI CSCL 11/8

The object of the work was to synthesize and study various hydroxyesters as potential components of low-hygroscopic brake fluids. Seventeen diesters of malic acid were prepared via modified Fischer esterification and in nearly quantitative yields. They were subjected to screening tests. None proved entirely satisfactory, although several of the malates exhibited properties which may be desirable in blending. Author (TAB)

N69-41039# Tecnische Hochschule Munchen (West Germany).
RELATIONSHIP BETWEEN THE FORMATION OF FRICTION-REDUCING LAYERS AND THE CHEMICAL CONSTITUTION OF SELECTED ADDITIVES AND ESTER OILS [ZUSAMMENHAENGE ZWISCHEN DER BILDUNG ABRIEEBVERMINDERNDER SCHICHTEN UND DER CHEMISCHEN KONSTITUTION VON AUSGEWAEHLTEN ADDITIVEN UND ESTEROELEN]
Kenneth A. Davis 1969 95 p refs In GERMAN
Avail: CFSTI

Organic phosphorus, sulfur, and chlorine compounds as well as selected carbonic acid and organometallic compounds were evaluated for their effects as additives on the lubrication efficiency of thermal stabilized ester oils in turbine engines. Studied were additive concentrations, additive combinations, and their effective

changes in lubrication properties. Correlations between chemical structure friction coefficients and lubricating effectiveness showed that additive mixtures, consisting of single components with overlapping spheres of effectiveness, improved the friction characteristics of lubricating ester oils considerably. Transl. by G.G.

N69-41060# RAND Corp., Santa Monica, Calif.
HIGH MECHANICAL PERFORMANCE: POTENTIALITIES OF FIBER REINFORCEMENT
Donald F. Adams Jul. 1969 19 p refs Presented at the Joint Conf. of the Plastics Inst. and the Soc. of Plastics Engr., London, 16 - 17 Jun. 1969
(AD-691504; P-4149) Avail: CFSTI CSCL 11/4

Polymers are not normally considered to be high mechanical performance materials; reinforcement with very high strength and stiffness fibers, particularly boron and graphite, has created a whole new class of materials. Some aspects of utilizing these composites are presented, including both analytical and experimental considerations. Current hardware applications are reviewed, indicating the increasing interest in this area. Probable future developments are discussed, including the likely range of applications of polymer matrix composites and possible competition from other material systems. Author (TAB)

N69-41070# Sandia Corp., Albuquerque, N. Mex.
A SURVEY OF LOW TEMPERATURE POLYMERS
K. B. Wischmann Mar. 1969 37 p refs Sponsored by AEC
(PB-183632; SC-DR-60-898) Avail: CFSTI CSCL 11I

This paper presents a cursory survey of the literature on low temperature polymers. Emphasis was placed on thermoplastic as opposed to thermoset polymers. In an attempt to answer the primary question of what constitutes a good low temperature polymer, the following topics are discussed: (1) effect of polymer structure on low temperature stability, (2) mechanical properties of various polymeric structures, and (3) test methods for low temperature materials. Author (USGRDR)

N69-41071# Sandia Corp., Albuquerque, N. Mex.
A PROCEDURE FOR APPLYING A PROTECTED LAYER OF LIQUID CRYSTALS
D. Bishop Nov. 1968 7 p Sponsored by AEC
(PB-183838; SC-TM-68-721) Avail: CFSTI CSCL 11C

The memorandum describes a method of applying temperature-sensitive liquid crystals to a strong, flexible, portable backing with a coating over the crystals to protect them from physical contact and contamination. Author (USGRDR)

N69-41072# Sandia Corp., Albuquerque, N. Mex.
FURTHER PHYSICAL PROPERTY CHARACTERIZATION OF 3.0 AND 6.0 LB/CU FT CARBON FOAMS
Peter B. Rand Mar. 1969 17 p refs Sponsored by AEC
(PB-183633; SC-DR-69-113) Avail: CFSTI CSCL 11B

The results of additional test programs on 3.0 and 6.0 lb/cu ft. carbon foams are presented. These data provide a better characterization of their physical properties. The results of a round-robin test series and the resultant test specifications are also discussed. Author (USGRDR)

N69-41117# Naval Research Lab., Washington, D.C. Lab. for Chemical Physics.
SURFACE CHEMISTRY OF PLASTICS REINFORCED BY STRONG FIBERS
W. A. Zisman *In its* Report of NRL Progress Sep. 1969 p 10 - 29 refs (See N69-41115 24-34)
Avail: CFSTI

A critical and up-to-date review has been made on present knowledge of the surface chemistry and related polymer science involved in the reinforcement of thermosetting and thermoplastic materials by glass or other strong fibers. Although the emphasis is usually on the behavior of glass-reinforcing fibers and particles, wherever possible the discussion and conclusions are presented so as to allow their extension directly or by analogy to other strong reinforcing solids. A selected bibliography is given of the most significant scientific work published to date. The treatment of the subject is as fundamental as scope and reliability of available data permit. In many instances, available knowledge is interpreted by using the reviewer's judgment. Where significant gaps or conflicts are noted in the literature, they are discussed constructively. In the concluding sections numerous highly specific recommendations are made to stimulate or guide future research and development in this complex field. Author

N69-41155*# Ball Brothers Research Corp., Boulder, Colo.
CATEGORY AND CONTAMINATION RANKING LISTS FOR OSO MATERIALS
J. D. Austin 1 Mar. 1969 16 p
(TR-69-08) Avail: CFSTI

Materials lists are presented to aid spacecraft experimenters and designers in choosing materials having low potentials for surface contamination of critical parts for Orbiting Solar Observatories. Test samples of a material and an optical element are exposed to a high vacuum for 24 hours at 100° and 25°C respectively during the test. The weight of both items and the light scattered by the optical element are measured before and after the test. The combined data give a relative measure of the potential of the material to produce a contaminant film on an optical surface. The materials tested have been placed in 35 separate categories according to usage. The materials of each category are ranked from least contaminating at the top of each list to most contaminating at the bottom as measured by the vacuum exposure nepheleometer (VEN) tests. Notes following each material state times, temperature, etc. Author

N69-41226# Bureau of Mines, College Park, Md.
GAMMA AND BETA DISTRIBUTION FUNCTIONS APPLIED TO SIZE DISTRIBUTION OF MINERAL PRODUCTS
Hillary W. St. Clair Nov. 1969 35 p refs
(BM-RI-7309) Avail: Issuing Activity

A mathematical procedure for analyzing size distribution data by the method of moments is described. The method was applied to data on a variety of grinding mill products. It was found that the observed size distributions could be represented by gamma and beta distribution functions over a wide range of sizes. A computer program, written in BASIC, is described for calculating moments, distribution parameters, and the weight fraction in any size range. Author

N69-41266# California Univ., Livermore. Lawrence Radiation Lab.
PREPARATION AND PROPERTIES OF 2-2-DIFLUORO-2-NITROETHYL ACRYLATE POLYMERS
Eugene R. Bissell 1 Aug. 1968 9 p refs
(Contract W-7405-eng-48)
(UCRL-50464) Avail: CFSTI

Various 2,2-difluoro-2-nitroethyl acrylate polymers and copolymers were prepared and their properties observed in an effort to find a polymer best suited for making extrusion case explosives and binders for explosives. Plasticizers significantly lowered the glass transition temperature of the homopolymer, but copolymerization has much less effect. Most cross linking agents greatly improved the mechanical properties of the polymers without significantly altering their glass transition temperature.
Author (NSA)

N69-41277# Johns-Manville Research Center, Manville, N.J.
DEVELOPMENT OF 400 TO 2200F FIBROUS-TYPE INSULATIONS FOR RADIOISOTOPE POWER SYSTEMS
Quarterly Progress Report, 1 Jul.-30 Sep. 1968
J. O. Collins, K. L. Jaunarass, and D. R. Reid 1 Oct. 1968 65 p
(Contract AT(30-1)-3633)
(ALO-3633-10) Avail: CFSTI

The study of the basic phenomenon of sintering, and

particularly that of submicron silica and alumina particles was completed. Thermal stability, thermal conductivity porosity, and electron microscope evaluations all point to a particle agglomeration at temperatures lower than expected for these oxides. Materials studies were also completed for ALON-C, K_2CO_3 shrinkage inhibitor, and ZrO_2 opacifier combinations. In light of the agglomeration tendencies, the effect of the shrinkage inhibitor on the ALON-C must be studied over extended periods of life testing before the true product characteristics can be determined. Comparison of opacified and unopacified Glasrock foam silica thermal conductivities at various densities showed the ineffectiveness of the opacifiers within the normal product density range. Author (NSA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N69-40005# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

METHOD FOR FINDING THE FUNCTIONAL RELATIONS IN THE CHEW-LOW TYPE EQUATIONS

V. A. Meshcheryakov and K. V. Rerikh 1969 17 p refs In RUSSIAN

(JINR-P2-4377) Avail: AEC Depository Libraries

A method is suggested for finding the functional relations between the matrix elements of S-matrix in the Chew – Low type equations. The method is formulated for equations with the 3×3 matrix of the crossing symmetry. This method is applied when finding the polynomial functional relations in the equations with A(1,1) matrix. Two functional relations are found. It is proved that other polynomial functional relations for A(1,1) do not exist. Author (NSA)

N69-40012# Washington Univ., Seattle.

SEMI-SQUARE SUMMABLE FOURIER-STIELTJES TRANSFORMS

I. Glicksberg [1968] 11 p refs Sponsored in part by NSF

Avail:Issuing Activity

A locally compact Abelian group with dual gamma functions having a finite regular Borel measure with a Fourier – Stieltjes transform is discussed. Conditions are given for the existence of the negative half of the gamma function considering the function to be an algebraically totally ordered Abelian group; the Stieltjes transform is square integrable on the negative half of the gamma function. Similar cases are shown for which the gamma function is partially ordered by a non-zero homomorphism with the common null sets known, and it is noted how function algebra results apply in sometimes weaker but more obscure hypotheses. Proofs of theorems are given involving the gamma functions and the negative halves of the gamma functions. Author

N69-40081 National Lending Library for Science and Technology, Boston Spa (England).

ON THE THEORY OF THE REDUCTION OF SHORT TIME SERIES TO A LONG PERIOD

A. S. Marchenko et al 1 May 1969 17 p refs Transl. into ENGLISH from Glav. Uprav. Gidrometeorol. Sluzh., Met. Gidr. (Leningrad), no. 2, 1968 p 27 – 34

(NLL-M-569-(9022.551)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The question is discussed of the advisability of reducing a given short series to a long period in the cases when, instead of the true values, only sample values of the required statistical parameters are known. Author

N69-40088*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

APPLICATION OF MODERN NETWORK THEORY TO ANALYSIS OF COMPLEX SYSTEMS

John C. Faken Washington Oct. 1969 46 p refs

(NASA-TN-D-5511) Avail: CFSTI CSCL 12A

Present day systems have grown to exceed the intuitive grasp of systems analysts, thus negating the value of techniques which depend upon intuition as a substitute for mathematical rigor. A methodology based on the Modern Network Theory of electrical engineering is presented which, when considered in the light of digital computer technology, shows up as a capable and powerful tool for the analysis of complex systems. The examples presented to demonstrate the various techniques show that Modern Network Theory is not limited to electrical systems but appears to be applicable to systems in general. Author

N69-40155# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

SPACE SYNTHESIS: AN APPLICATION OF THE SYNTHESIS METHOD TO TWO- AND THREE-DIMENSIONAL MULTIGROUP NEUTRON DIFFUSION EQUATIONS [SYNTHESE SPATIALE: UNE APPLICATION DE LA METHODE DE SYNTHESE AUX EQUATIONS DE DIFFUSION NEUTRONIQUE MULTIGROUPE A DEUX ET TROIS DIMENSIONS]

Hoan Nguyen-Ngoc May 1969 72 p refs In FRENCH; ENGLISH summary

(CEA-R-3713) Avail: CFSTI

In order to reduce computing time, two- and three-dimensional multigroup neutron diffusion equations in cylindrical, rectangular (X, Y), (X, Y, Z) and hexagonal geometries are solved by the method of synthesis using an appropriate variational principle stationary principle). The basic idea is to reduce the number of independent variables by constructing two- or three-dimensional solutions from solutions of fewer variables, hence the name 'synthesis method'. A system of ordinary differential equations with matrix coefficients to which one can apply well-known numerical methods, e.g. Chebyshev's polynomial method, Gaussian elimination, must be solved. Numerical results obtained by synthesis programs written for the IBM 7094, IBM 360-75 and CDC 6600 computers, are compared with those given by programs employing the classical finite difference method. Author (ESRO)

N69-40210 Purdue Univ., Lafayette, Ind.

MEASURES AND TECHNIQUES FOR INTERSET FEATURE SELECTION

Thomas Francis Krile (Ph.D. Thesis) 1968 114 p refs

Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-2940

The basic measure of feature effectiveness is the recognition error resulting when a set of features is presented as the input to a pattern classifier. This measure is very difficult to calculate, however, an algorithm is developed with which the recognition error can be calculated exactly for the case of an optimum Bayes' classifier and multivariate Gaussian feature statistics. The error is first expressed in terms of the distribution of the one-dimensional quadratic discriminant function. After a transformation of the feature variables, the Fourier transform of the density of the discriminant function is obtained. The recognition error is then related to the inverse of this transform. Since the calculation of the recognition error with this algorithm involves a numerical integration, an approximation algorithm is also developed. An example showing results with these algorithms is given. Finally, the problem of how to apply these measures of feature effectiveness is discussed. Dissert. Abstr.

N69-40241*# Pittsburgh Univ., Pa. Dept. of Electrical Engineering.

ON THE STABILITY OF NONLINEAR OPERATOR DIFFERENTIAL EQUATIONS, AND APPLICATIONS

C. V. Pao and William G. Vogt 27 Apr. 1969 28 p refs

(Grant NGR-39-011-039)

(NASA-CR-106300) Avail: CFSTI CSCL 12A

Consider the nonlinear operator differential equation of

evolution $dx(t)/dt = Ax(t) + f(x(t))$ with t greater than or equal to zero and where A is a linear, unbounded operator with domain and range both in a real Hilbert space H and f is a nonlinear function defined on H into H. The existence, the uniqueness and the stability or asymptotic stability of solutions to the equation of evolution by using nonlinear semigroup properties are investigated. Criteria on A and on f for the generation of a contraction or negative contraction semigroup are established from which the existence, uniqueness, stability and asymptotic stability of solutions of the equation of evolution are insured. Applications are given to the second order partial differential equation. Author

N69-40245*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EXTENSIVE ENGLISH LANGUAGE BIBLIOGRAPHY ON GRAPH THEORY AND ITS APPLICATIONS
Narsingh Deo 15 Oct. 1969 86 p refs
(Contract NAS7-100)
(NASA-CR-106288; JPL-TR-32-1413) Avail: CFSTI CSCL 12A

An up-to-date and complete English language bibliography in linear graph theory (or network theory) and its applications is presented. It has about 2200 entries, which include almost all significant works published on the subject in the English language, original or translated, prior to April 1969. A brief introduction to the theory and applications of graphs is included. Short reviews of 18 books, eight of which are text books on graph theory, are also contained. Author

N69-40248# Army Foreign Science and Technology Center, Washington, D.C.
CHARACTERISTIC RADICALS OF STOCHASTIC MATRICES
N. E. Dmitriev 25 Apr. 1969 33 p Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Mat. (Moscow), no. 10, 1946 p 167-184
(AD-690745; FSTC-HT-23-372-68) Avail: CFSTI CSCL 12/1

The paper investigates the distribution on a complex plane of characteristic radicals of stochastic matrices of the n-th order. The results obtained can be interpreted as theorems on the relative distribution of characteristic radicals of an arbitrary matrix with non-negative elements. Author (TAB)

N69-40276 Stanford Univ., Calif.
COMPUTER ALGORITHMS FOR DIRAC ALGEBRA, RELATIVISTIC POSITRON-ELECTRON BREMSSTRAHLUNG AT WIDE ANGLES AND UNITARITY CONSTRAINTS ON THE MANDELSTAM REPRESENTATION
Stanley Mardon Swanson (Ph.D. Thesis) 1968 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-300

The first part of this work is a collection of algorithms written in ALGOL 60 to illustrate the manipulation techniques used in machine language programs designed for symbolic evaluation of algebraic expressions. In the second part, these algorithms were used in the evaluation of the bremsstrahlung spectrum for relativistic positron-electron collisions. The Dirac traces for the exact, lowest-order differential cross section were reduced to invariants on a computer and further simplified until reasonably compact expressions were obtained. The phase-space integrals were evaluated numerically for photon emission angles of roughly 30° to 120° from the incident particles in the c.m. system. It was found that certain relativistic approximations to the spectrum, valid for forward angles, are still fairly good at wide angles. The last part is distinct and is a short investigation of the structure imposed upon scattering amplitudes by the general quantum mechanical principles of unitarity and crossing symmetry. Dissert Abstr

N69-40277 Brandeis Univ., Waltham, Mass.
MANY BODY THEORY WITH POINT TRANSFORMS
Norman Martin Witriol (Ph.D. Thesis) 1968 180 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-2069

The method of point transforms, assuming pairwise additivity is applied to the many body hard core Fermi system. The ground state energy and Landau parameters are found to second order in the hard core radius. The dilute gas limit results are in agreement with those of Huang and Yang, and Abrikosov and Khalatnikov. Methods of extending the calculation to denser systems via the determination of the cutoff function of the transformation are discussed. Secondly a set of regional point transforms is developed which can be used to consider the truly many body terms of many body systems. Due to the regional nature of the transformation, the Hamiltonian and wavefunction of an N body system can easily be approximated by two body, three body, ... or N body additivity. The method is particularly suited for systems with short range, strongly repulsive interactions. Dissert. Abstr.

N69-40278 California Inst. of Tech., Pasadena.
SOME PROPERTIES OF THE COEFFICIENTS OF CYCLOTOMIC POLYNOMIALS
Kau-un Lu (Ph.D. Thesis) 1968 69 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-524

An explicit formula is obtained for the coefficients of the cyclotomic polynomial $F_n(x)$, where n is the product of two distinct odd primes. A recursion formula and a lower bound and an improvement of Bang's upper bound for the coefficients of $F_n(x)$ are also obtained, where n is the product of three distinct primes. The cyclotomic coefficients are also studied when n is the product of four distinct odd primes. A recursion formula and upper bounds for its coefficients are obtained. Included is a different approach to the cyclotomic coefficients. A connection is obtained between a certain partition function and the cyclotomic coefficients when n is the product of an arbitrary number of distinct odd primes. Finally, an upper bound for the coefficients is derived when n is the product of an arbitrary number of distinct odd primes. Dissert. Abstr.

N69-40281 Delaware Univ., Newark.
THE SOLUTION OF UNSTEADY STATE MULTICOMPONENT DISTILLATION USING PARTIAL DIFFERENTIAL EQUATIONS
Adam Osborne (Ph.D. Thesis) 1968 375 p
Avail: Univ. Microfilms: HC $16.90/Microfilm $4.80 Order No. 68-15546

A mathematical model is developed for unsteady state multicomponent distillation, with a view to enabling the calculation of dynamic responses in large multicomponent distillation columns. The mathematical model is based on the simultaneous solution of a family of first order partial differential equations, using Runga - Kutta - Gill numerical integration to represent continuous integration in the equilibrium stage coordinate, and taking discrete steps in the time co-ordinate. A computer program is presented, based on the DES-1 language and system implemented on the SDS 9300 computer. A version of the program written entirely in Fortran IV is also included, together with some discussion of this problem as a natural candidate for solution on a hybrid computer. Dissert. Abstr.

N69-40283# Florida State Univ., Tallahassee
SPHERES UNIFORMLY WEDGED BETWEEN BALLS ARE TAME IN E SUP 3
H. C. Griffith 1968 4 p refs Submitted for publication
(Grant NSF G-5458)
Avail: Issuing Activity

The proof of the theorem, if there is a radius > 0 such that the 2 sphere set in E^3 is wedged between tangent balls of radius at each of its points then the set is tame, is reviewed. An example is given of a sphere which is wedged between tangent balls at each of its points, but for which no such radius exists. Author

N69-40327# Stanford Univ., Calif. Dept. of Computer Science.
A MACHINE ORIENTED FORMULATION OF THE

EXTENDED FUNCTIONAL CALCULUS
Patrick J. Hayes [1969] 45 p refs
(Contract ARPA SD-183)
(AD-691788; AI-MEMO-86) Avail: CFSTI CSCL 12/1

The Extended Functional Calculus (EFC), a three-valued predicate calculus intended as a language in which to reason about the results of computations, is described in some detail. A formal semantics is given. A machine-oriented (axiomless) inference system for EFC is then described and its completness relative to the semantics is proved by the method of Semantic Trees. Finally some remarks are made on efficiency. Author (TAB)

N69-40346# Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering.
NUMERICAL SOLUTION OF THE TWO-DIMENSIONAL TIME-DEPENDENT MULTIGROUP EQUATIONS
William T. McCormack, Jr. (Ph.D. Thesis) and Kent F. Hansen May 1969 79 p refs
(Contract AT(30-1)-3903)
(MIT-3903-1; MITNE-99) Avail: CFSTI

A numerical algorithm for the solution of the two-dimensional time-dependent multigroup neutron diffusion equations is presented. The method assumes that the variation in the neutron flux at each mesh point can be represented as an exponential function of time over each integration time step. Additionally, the assumption is made that the transverse leakage in one spatial direction can be approximated by a pointwise transverse buckling over one time step. These assumptions, together with an appropriate factoring and integration of the matrix form of the semi-discrete multi-group equations, produce a mathematically consistent approximation and an unconditionally stable algorithm. It is also shown that the asymptotic numerical solution is proportional to the asymptotic eigensolution of the semi-discrete multigroup equations. The experimentally observed truncation error is discussed and several numerical experiments are presented which illustrate the accuracy and utility of the method. Author (NSA)

N69-40399# North Carolina Univ., Chapel Hill. Statistics Dept.
STOPPING TIMES ON BROWNIAN MOTION: SOME PROPERTIES OF ROOT'S CONSTRUCTION
R. M. Loynes Jul. 1969 18 p refs
(Contract Nonr-855(09))
(AD-691827) Avail: CFSTI CSCL 12/1

Root recently described a method of constructing an absorbing barrier for Brownian motion with the property that the value of the process at the moment it stops has any desired distribution with zero mean and finite variance. Further properties of the construction are investigated here, concerning uniqueness and continuity. Author (TAB)

N69-40442# Institute for Defense Analyses, Arlington, Va.
THE USE OF TCHEBYCHEFF-TYPE INEQUALITIES TO BOUND THE UPPER LIMIT OF A COST ESTIMATE
Morris J. Zusman Jan. 1969 41 p refs
(AD-691823; RP-P-478) Avail: CFSTI CSCL 5/1

A method is presented that can be used to calculate an upper tolerance limit on the probability that the actual cost of a future system will exceed the estimated cost by an amount delta, as a function of delta. The method may also be used to test whether estimated cost differences between alternatives are significant. The method which uses Tchebycheff-type inequalities to bound the system cost only requires the assumption that the maximum cost of any element be finite and the estimated cost be an unbiased estimator. A set of inequalities is presented so that, if the analyst is willing to make additional assumptions about the form of the underlying cost probability distribution (e.g., unimodal), tighter tolerances may be drawn. The method is illustrated by a hypothetical example. Author (TAB)

N69-40450 Virginia Univ., Charlottesville.
ON K SUB *(BG) FOR G: A FINITE ABELIAN GROUP
James Whitfield Vick (Ph.D. Thesis) 1968 78 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-18241

Associated with the unitary spectrum there are generalized homology and cohomology theories. The purpose of this research was to make certain computations of these theories for classifying spaces of finite abelian groups. Generalized homology and cohomology theories and the relationship between the groups of a CW complex and the direct and inverse systems formed by their subcomplexes is described. There is a pairing of this spectrum with itself, which induces various products on the theories. These products along with free resolutions derived are used to demonstrate Künneth formulas and coefficient theorems for the two theories. The construction of the classifying spaces for cyclic groups of prime power order is given. Dissert. Abstr.

N69-40452# Southern Methodist Univ., Dallas, Tex. Statistics Dept.
ON THE STEPWISE CONSTRUCTION OF A PREDICTION EQUATION
Paul Terrell Pope 25 Jun. 1969 56 p refs
(Contract N00014-68-A-0515)
(AD-691298; TR-37) Avail: CFSTI CSCL 12/1

At some stage of the forward selection procedure when p variables are being considered for entry into the equation, the ratio $F_i = SSR_i/MSE$ is computed for each variable being considered. If the ratio $F = \max(F_1, F_2, \ldots, F_p)$ is greater than some constant F_O, the variable x_i associated with this maximum ratio is included in the equation. The joint distribution of $F_1, F_2, \ldots, F_p$ is determined under the usual assumptions for the regression model; including normality of the error. Through this the distribution of F is given. Different philosophies exist concerning the choice of the value for F_O. The probability integral of F is computed for $p = 3$ and comparisons are made among the critical points for these different philosophies. Author

N69-40459# Naval Postgraduate School, Monterey, Calif. Dept. of Electrical Engineering.
DETERMINATION OF DIRECT TREES BY THE T-TRIANGLE METHOD
Carl Edward Willman (M.S. Thesis) Apr. 1969 34 p refs
(AD-691761) Avail: CFSTI CSCL 9/5

A method for determining all of the direct trees of an oriented graph is presented. This method, the T-triangle method, is suitable for either hand calculation or computer implementation. The method is simple, contains a minimal amount of steps, and generates all of the direct trees without any duplications. Author (TAB)

N69-40462# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
SOME SELECTION PROCEDURES WITH APPLICATIONS TO RELIABILITY PROBLEMS
Shanti S. Gupta and Gary C. Mc Donald (Gen. Motors, Detroit) Jun. 1969 12 p refs *Its* Mimeograph Ser. No. 195
(Contract Nonr-1100(26))
(AD-691803) Avail: CFSTI CSCL 14/4

The paper studies some ranking and selection procedures (also called multiple-decision procedures) which lend themselves to applications in reliability problems. Some of the procedures discussed are in a sense distribution free, while others assume a specific distributional form of the underlying observations. In addition, a parametric procedure for selecting a subset containing the gamma population with the largest guaranteed life is introduced. A comparison is then made between this parametric procedure and several others which are based on the ranks of the observations. This comparison is in terms of the expected number of population included in the selected subset. Author (TAB)

N69-40463# RAND Corp., Santa Monica, Calif.
A GENERALIZATION OF FEIT'S THEOREM

J. H. Lindsey, II Aug. 1969 22 p refs
(AD-691865; P-4166) Avail: CFSTI CSCL 12/1

This paper is part of a doctoral thesis titled-Finite Linear Groups in Six Variables. It is shown that I can prove that if p is a prime greater than five with p -1(mod 4), and G is a finite group with faithful complex representation of degree smaller than both 4p/3 and 3(p - 1)/2, then G has a normal p-subgroup of index in G divisible at most by p squared. These methods are particularly effective when there is nontrivial intersection of p-Sylow subgroups. Author (TAB)

N69-40477# Stanford Research Inst., Menlo Park, Calif. Mathematics and Statistics Dept.
APPLIED SPECTRAL ANALYSIS OF MIXED RANDOM AND DETERMINISTIC PROCESSES
George W. Evans and Robert Mc Carty Mar. 1969 189 p
(AD-691302) CSCL 9/4

Contents: Spectral analysis of nonstationary random processes; Numerical estimates for averages, variances, and standard deviations; Numerical estimates for the covariance and covariance spectrum; Smoothing, continuous and discrete; Spectral analysis of a single sample function; Calculation of the covariance spectrum for a nonstationary process. TAB

N69-40481# Birmingham Univ. (England). Dept. of Civil Engineering.
FINITE DIFFERENCE SOLUTIONS FOR AN UNSTEADY INTERFERENCE PARAMETER IN SLOTTED WIND TUNNELS
K. R. Rushton and Lucy M. Laing London HMSO 1969 23 p refs Sponsored by Min of Technol. Supersedes ARC-30834
(ARC-CP-1053; ARC-30834) Copyright. Avail: CFSTI

Three methods of determining an unsteady interference parameter in slotted wind tunnels are described. In each case the governing equation for the flow in the wind tunnel is Laplace's equation which is solved by a finite difference approximation. The methods differ in the representation of the disturbance due to the wing. A discussion of the merits of each method is included; results are quoted for tunnels of square section with roof and floor of varying slot parameter. Author (ESRO)

N69-40482# National Physical Lab., Teddington (England). Aerodynamics Div.
A NOTE ON THE RELATIONSHIP BETWEEN NOISE EXPOSURE AND NOISE PROBABILITY DISTRIBUTION
D. R. Johnson May 1969 12 p refs
(NPL-AERO-Ac-40) Copyright. Avail: CFSTI

In many noise situations, the statistical distribution of noise levels over a short sampling period follows approximately a normal probability curve. The energy mean noise level in such cases is shown to be simply related to the median or mean noise level and standard deviation by the expression LIeqB =LI50 + σE2B/8.668. The approximation involved in determining L by this simple formula in the case of alternative probability distributions is shown to be within acceptable limits. Author (ESRO)

N69-40487# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
SOME BAYES ESTIMATES OF LONG-RUN AVAILABILITY IN A TWO-STATE SYSTEM
D. P. Gaver (Westinghouse Research Labs.), and M. Mazumdar (Westinghouse Research Labs.) May 1969 27 p refs
(Contract Nonr-760(24))
(AD-691404; RR-161) Avail: CFSTI CSCL 14/4

The method of Bayesian statistical inference is used to derive estimates of operational parameters in a simple system that can be in one of two states: failed, or operative. The sampling plan consists of occasional observations of the system for finite periods: snapshop, plus patch sampling. Numerical examples are given. Author (TAB

N69-40492# Iowa Univ., Iowa City.
GRAPHS OF (0,1)-MATRICES
S. Hedetniemi Aug. 1969 33 p refs
(Contract N00014-68-A-0500)
(AD-691756; TR-14) Avail: CFSTI CSCL 12/1

A class of graphs is defined which is naturally suggested by a classical theorem of Konig-Egervary on (0,1)-matrices. Several characterizations of this class of graphs are obtained which reveal close connections between these graphs and line graphs, clique graphs, bipartite graphs and Berges perfect graphs. Finally, as a result of these characterizations and another well-known theorem of Konig we obtain the following result: if the clique graph K(G) of a graph G is bipartite, then the chromatic number chi(G) of G equals the number of points omega(G) in the largest complete subgraph of G. Author (TAB)

N69-40497# Washington Univ., Seattle. Mathematics Dept.
THE IMPORTANCE OF BEING STRAIGHT
Branko Gruenbaum Aug. 1969 21 p refs
(Contract N00014-67-A-0103)
(AD-691822; TR-18) Avail: CFSTI CSCL 12/1

Examples of open problems from three fields are used to discuss the thesis that our imperfect understanding of closely related objects is at the root of the difficulties encountered in solving the problems. The fields discussed are: (1) arrangements of lines, or of pseudolines, in the projective plane; (2) boundary complexes of polytopes, and combinatorial spheres; (3) boundary complexes of centrally symmetric polytopes, and combinatorial spheres with a center of symmetry. Author (TAB)

N69-40504# California Univ., Los Angeles. School of Engineering and Applied Science.
ON OPTIMAL CONTROL OF THE VIBRATING STRING
Kazimierz Malanowski Jul. 1969 19 p refs
(Grant AF-AFOSR-1408-68)
(AD-691856; AFOSR-69-1941-TR) Avail: CFSTI CSCL 12/1

The problem of minimization of total energy of the vibrating string in a given time is investigated. The boundary value control with constrained magnitude is considered. It is shown that this optimal control problem is equivalent to the determining of the minimum of some integral functional subject to constraints on the magnitude of the argument. The form of the optimal control function is characterized. It turns out that, in general, an optimal control of bang-bang type does not exist and the magnitude of the optimal control function is equal to the constraints only on some subintervals of the interval of control. Author (TAB)

N69-40520# Research Analysis Corp., McLean, Va.
PENALTY METHODS IN OPTIMAL-CONTROL THEORY
Arnold P. Jones and Garth P. Mc Cormick Jul. 1969 21 p refs
(Contract DAHC19-69-C-0017)
(AD-691322; RAC-TP-371) Avail: CFSTI CSCL 12/1

The recent appearance of a paper by A. V. Balakrishnan, in which a penalty function was used to remove the necessity of solving the dynamical equations in order to compute the solution of an optimal control problem, has motivated the developments presented here. Restricting ourselves to a fixed-end-point problem in optimal-control theory with special intermediate and control constraints, we prove that under certain restrictions one may replace this optimal-control problem by a sequence of unconstrained (free) variational problems by the use of a penalty function. This function incorporates the dynamical equations, intermediate-state constraints, and control constraints, as well as the initial-state constraint (initial condition) with appropriate penalties. Author (TAB)

N69-40538# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
ON COMPLEMENTARY POLAR CONICAL SETS
Christoph Witzgall May 1969 34 p refs *Its* Mathematical Note No. 608

(AD-691361; D1-82-0872) Avail: CFSTI CSCL 12/2

Tucker has formulated the Duality Theorem of Linear Programming in terms of orthogonality properties of a pair of complementary orthogonal linear manifolds with respect to the positive orthant. This theorem is generalized by substituting complementary polar conical sets for complementary orthogonal linear manifolds, and proved under simple stability assumptions. Equivalence to Feuchels Duality Theorem for conjugate convex functions is established. There are strong parallelisms to work by Kretschmer. Author (TAB)

N69-40549# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON SOME ESTIMATION AND DISTRIBUTION PROBLEMS
Suresh R. Paranjape Jul. 1969 38 p refs *Its* Mimeograph Ser. No. 194
(Contract N00014-67-A-0026-0008)
(AD-691802) Avail: CFSTI CSCL 12/1

The report deals with two estimation and two distribution problems. The window-estimators for the size and the location of a single, simple discontinuity of a density function have been studied. The distribution of the median of a special type of Gaussian process has been obtained. Some partial results on the distribution of the mean of the same type of Gaussian process are included. Author (TAB)

N69-40555 Marquette Univ., Milwaukee, Wis.
FINITE TIME STABILITY OF DYNAMICAL SYSTEMS
Anthony N. Michel (Ph.D. Thesis) 1968 319 p refs
Avail: Univ. Microfilms: HC $14.40/Microfilm $4.10 Order No. 69-3324

The purpose of the present investigation is to extend certain existing results for the case of continuous systems, to develop a theory of finite time stability of discrete systems, to establish a connection between finite time stability and classical stability, and to apply the developed theory to problems which are especially well treated by means of finite time stability. In both the continuous and the discrete case, the dynamical systems under consideration are general enough so as to include unforced systems, systems under the influence of perturbing forces, linear systems, nonlinear systems, time-invariant systems, time-varying systems, simple systems, and composite systems. In many cases where the finite time interval in question is very large, classical and finite time stability would appear to be overlapping concepts. Dissert. Abstr.

N69-40556 Connecticut Univ., Storrs.
OPTIMIZATION OF DISTRIBUTED PARAMETER SYSTEMS IN TWO INDEPENDENT VARIABLES
George Albert Russell (Ph.D. Thesis) 1968 69 p refs
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-2177

The problem of the optimum control of systems described by partial differential equations in two independent variables is studied. The problem is posed in terms of the system partial differential state equations, a hard constraint on the driving function, and a performance index expressed as a double integral with respect to the two independent variables. A principle of optimality for the two independent variable problem is stated and proven. Dividing the region over which the optimum solution is being sought into various sub-regions and applying the principle of optimality leads to an expansion of terms. To carry out the expansion it is necessary to introduce a variational notation and the operation of functional partial differentiation. Rearranging terms and again applying the principle of optimality leads to the basic equation for the two dimensional optimum control problem. This basic equation states that the optimal driving function must maximize a certain integral expression. Dissert. Abstr.

N69-40561 Colorado State Coll., Greeley.
ON GENERALIZATIONS OF THE DARBOUX PROPERTY
Joseph L. Teeters (Ph.D. Thesis) 1968 56 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-2872

The historical background and evolution of mathematical concepts related to the Darboux property and various known generalizations of the Darboux property are discussed and compared. Historical evidence indicates that important contributions relating to the intermediate value property were made by Darboux in 1875, Volterra in 1881, Lebesgue in 1904, Denjoy in 1915, Gillespie in 1922, and by Maximoff in 1940. The intermediate value property is called the Darboux property because of the contributions by Darboux. The generalizations discussed are those authored by Ellis in 1951, Csaszar in 1952, Halperin in 1955, and Bruckner, Ceder, Weiss in 1966. Examples by Darboux and Lebesgue which have important historical and mathematical significance are provided. Dissert. Abstr.

N69-40562 Carnegie-Mellon Univ., Pittsburgh, Pa.
ALGORITHMS AND RECURSIVE FUNCTIONS
Donald Howard Taranto (Ph.D. Thesis) 1968 236 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.05 Order No. 68-17616

Two major concepts, computability and recursiveness, and the relationships that exist within and between these concepts, are presented. Markov algorithms and Turing machines are studied as examples of computability, and μ-recursive functions and general recursive functions are studied as examples of recursiveness. The equivalence of these four concepts is used to justify the philosophical position known as "Church's Thesis," such justification being the primary motivation and unifying force behind the ideas presented. Also playing a prominent role in the presentation is the notion of a decision problem and its relationship to recursiveness. Dissert. Abstr.

N69-40564 Illinois Univ., Urbana.
PSEUDO-PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS
Ralph Edwin Showalter 1968 75 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-1446

A mixed initial boundary value problem appears in fluid mechanics and soil mechanics for a partial differential equation of the form $M \frac{\partial}{\partial t} u(x,t) + L\,u(x,t) = f(x,t)$ where M and L are second order elliptic differential operators. The solution sought is a function of the n-dimensional space variable and the time. This problem is generalized and studied in various function spaces in which the questions of existence, uniqueness, regularity, and asymptotic behavior of the solution are answered. In particular some well known results for the Dirichlet problem can be applied with techniques from functional analysis to show under appropriate conditions on the boundary for the problem that the solution is for each fixed t just as smooth as the initial function, the coefficients of M and L, and the non-homogeneous term allow it to be. Furthermore conditions are stated under which the solution is at each fixed point of the domain an analytic function in the time variable. Dissert. Abstr.

N69-40565 Miami Univ., Fla.
AMITSUR RADICALS
Augusto Herminio Ortiz-Suarez (Ph.D. Thesis) 1968 37 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-2689

A new method of obtaining radicals is introduced. This method makes use of an existing radical property S and the related ring $R[x]$, where x is a commutative indeterminate over R. Thus given a radical property S, the ideal $S_A(R) = S(R[x]) \cap R$ of R is defined. It is shown that for a large class of radicals, S_A is again a radical. Namely, if S is a semiprime radical, then S_A is a (semiprime) radical. S_A is always contained in S but they do not, in general, coincide. If S is a special radical, then S_A is again a special radical. In some cases S_A determines the S-radical of

R[x]. These results are then generalized to the semigroup ring R(A), of a semigroup with an identity adjoined. Finally a class of radicals is introduced which contains many non-semiprime radicals. Some of these are shown to admit an Amitsur radical S_A. Dissert. Abstr.

N69-40566 Michigan Univ., Ann Arbor.
PERIODIC SOLUTIONS OF CERTAIN WEAKLY NONLINEAR HYPERBOLIC PARTIAL DIFFERENTIAL EQUATIONS
Abraham Naparstek (Ph.D. Thesis) 1968 233 p
Avail: Univ. Microfilms: HC $10.00/Microfilm $3.05 Order No. 69-2364

The questions of existence and uniqueness of periodic solutions of a class of weakly nonlinear hyperbolic partial differential equations of the second order are investigated. Certain instability properties of the linear hyperbolic differential operators which are involved in the nonlinear equations are studied. The composition of functions in appropriate Sobolev spaces defining the nonlinear operator N_μ is covered. The projection method of Cesari and Hale is employed and the modified, or relaxed functional-differential equation $Q_\sigma L_\sigma u = Q_\sigma N_\mu u$ in suitable Sobolev spaces, where Q_σ is the projection operator on the nonresonant subspace of L_σ, is studied. The question of the existence and uniqueness of solutions on the torus of the original equation is then reduced by this process to the investigation of solutions of the resulting bifurcation equation $D_\mu \chi = 0$, where D_μ is the nonlinear bifurcation operator on the resonant subspace, which depends on σ. Results in the noncritical case, i.e., for $\sigma \in E$, are new. Although the rational case has been studied before, the hypothesis on N_μ is weaker, the criteria for the solution of the bifurcation equation are more explicit, and a greater variety of equations is treated. The results for the linear hyperbolic differential operators on the torus are also new. Dissert. Abstr.

N69-40579# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
AVERAGED STATIONARY PRINCIPLES
Frederic Bisshopp and Raymond B. Wilson Nov. 1968 49 p refs
(Contract Nonr-562(42))
(AD-691777; TR-7) Avail: CFSTI CSCL 12/1

Solutions of certain hyperbolic systems of nonlinear partial differential equations are discussed. For convenience only two independent variables are considered, namely x and t, and if the equations have coefficients which are independent of x and t one can seek plane wave solutions of the form f(kx-omega t), with k and omega constant. If the coefficients have only slow explicit dependence on x and t one no longer has plane wave solutions, but one can seek solutions in the form of almost plane waves, f(theta), where k(x,t) is identically equal to theta sub x, omega (x,t) is identically equal to minus theta sub t are slowly varying functions of x and t. Author (TAB)

N69-40581# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
DECISION-THEORETIC EVALUATION OF SOME NON-PARAMETRIC METHODS
Herman Rubin Jul. 1969 10 p refs *Its* Mimeograph Ser. No. 193
(Contract N00014-67-A-0226-0008)
(AD-691801) Avail: CFSTI CSCL 12/1

The Kolmogorov-Smirnov test is compared to the median for one-sided and two-sided alternatives. In the two-sided case, although the asymptotic Bayes risk efficiency is the same for symmetric unimodal distributions, the relative efficiency approaches one slowly. In the one-sided case, the efficiency depends heavily on the test. For uniform alternatives, the K-S test is much better than the median, and the test based on the difference of the positive and negative deviations is still better. This latter test appears to have good properties even when the one-sided K-S test does not. Author (TAB)

N69-40591# Washington Univ., Seattle. Dept. of Mathematics.
ON COMBINATORIAL SPHERES
Branko Gruenbaum Jun. 1969 7 p refs
(Contract N00014-67-A-0103-0003)
(AD-691445; TR-16) Avail: CFSTI CSCL 12/1

The paper describes combinatorial spheres which are not isomorphic to the boundary complex of any convex polytope. Special attention is devoted to the case of centrally symmetric combinatorial spheres; examples are given which show that such spheres may be more neighborly than centrally symmetric polytopes. Author (TAB)

N69-40617 Brandeis Univ., Waltham, Mass.
THE CALCULATIONS OF VARIATIONS AND GLOBAL ANALYSIS
Karen Keskulla Uhlenbeck (Ph.D. Thesis) 1968 139 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-2068

Let M be a compact n-manifold with a smooth measure $d\mu$ and p: $E \to M$ a C^∞ fiber bundle over M. A k^{th} order Lagrangian for E is a C^1 real-valued function L on the k^{th} jet bundle of E. Associated with every Lagrangian is the functional $J(s) = \int_M L(j^k_x s)\, d\mu$ which is C^1 on $C^k(E)$. The Dirichlet problem with data given by $\lambda \in C^\infty(E)$ is to find the critical points among the functions $s \in C^l(E)$: $j^{k-1}_x s = j^{k-1}_x \lambda$ for $x \in M$. (l is either k or ∞.) If J extends to a C^1 function on the Banach manifold $L^p_k(E)$, for $k > n/p$, one can attempt to exhibit the critical points of $J \mid L^p_{k,\lambda}$ (E) where $L^p_{k,\lambda}(E)$ is the closure in $L^p_k(E)$ of the set $\{s \in C^\infty(E): s = \lambda$ in a neighborhood of $\partial M\}$, and to prove that these critical points are C^k or C^∞ to solve the original problem. Theorems are used to prove the existence of critical points. Dissert. Abstr.

N69-40718# Royal Aircraft Establishment, Farnborough (England).
THE APPLICATION OF VISUAL LOBE SEARCH THEORY TO AIR TO GROUND TARGET DETECTION
L. J. Smith and A. R. Runnalls Oct. 1968 61 p refs
(RAE-TR-68253) Avail: CFSTI

Details are given of how a mathematical model, based on search theory and target size and contrast, can be programmed for a digital computer to enable the cumulative probability of detection of a ground target from the air to be determined as a function of range. This is applied to cover both visual and televisual viewing for flat targets and for targets of fixed presented area. An account of some of the difficulties involved is included, together with justification of some of the simplifications found possible. Author (ESRO)

N69-40736# California Univ., Livermore. Lawrence Radiation Lab.
COMPUTER GENERATION OF SERIES AND RATIONAL FUNCTION SOLUTIONS TO PARTIAL DIFFERENTIAL INITIAL VALUE PROBLEMS
F. C. Gey and M. B. Lesser Mar. 1969 34 p Held at the Natl. Assoc. of Computing Machinery Conf., San Francisco
(Contract W-7405-eng-48)
(UCRL-18775) Avail: CFSTI

Series and rational function approximations provide a viable alternative to finite difference methods in the solution of partial differential initial value problems. Large scale symbolic algebra manipulation systems can be used to generate such approximations for a very general class of problems. The use of operator derivatives keeps the method from being limited to ordinary power series. The procedure is applied to the non-linear Burgers' equation $u_t + u \cdot u_x = u_{xx}$ with periodic initial condition $u(x,0) = \sin(x)$, and the results are compared to an asymptotic expansion and a finite difference solution. Author (NSA)

N69-40745# Air Force Cambridge Research Labs., Bedford, Mass.
ON THE EXTENSION OF BINARY SET COMPUTATION TO THE COMPUTATION OF MATRICES WITH ELEMENTS IN A COMPLETE BOOLEAN ALGEBRA

Jacques Riguet Jun. 1969 9 p refs Transl. into ENGLISH from Compt. Rend. Acad. Sci. (Paris), no. 238, 1954 p 2382 - 2385
(AD-691429; AFCRL-69-0276; Trans-52) Avail: CFSTI CSCL 12/1

It had been pointed out in connection with the theory of switching networks that the computation of matrices with elements in a Boolean algebra was quite analogous to that of binary sets. That is developed in this note. Author (TAB)

N69-40770# Houston Univ., Tex.
A DIGITAL COMPUTER PROGRAM TO DETERMINE THE EXPECTED MEAN SQUARES FOR AN ANALYSIS OF VARIANCE
Don M. Ingels Mar. 1969 39 p refs
(Contract N00014-68-A-0151)
(AD-691392; RE-1-69) Avail: CFSTI CSCL 12/1

Experimental data are frequently analyzed using an analysis of variance. The expected values of the mean squares, (expected mean squares) are used to determine the proper ratios for tests of hypothesis and to obtain equations to estimate components of variance. The algebraic derivation of the EMS expressions can be quite tedious if the design involves both fixed and random effects. A digital computer program described herein was used to determine the EMS expressions for designs which contain up to 512 effects. Author (TAB)

N69-40785# Naval Research Lab., Washington, D.C.
PROBABILITY DENSITY FUNCTIONS OF n VECTORS ADDED WITH RANDOM DIRECTIONS
Edward L. Wright Jul. 1969 15 p refs
(AD-691770; NRL-6922) Avail: CFSTI CSCL 12/1

The probability density function of the resultant amplitude of n vectors in two dimensions, added with random directions, was calculated through an integral transformation which takes a probability density function for k components into a probability density function for k + 1 components. Examples were calculated to show the qualitative aspects of the density functions for 2, 3, and 4 components, with arbitrarily given magnitudes. For n = or > 5, the probability distribution rapidly approaches the Rayleigh distribution. The method also allows the use of a Rayleigh vector as one of the components. Author (TAB)

N69-40796# Naval Postgraduate School, Monterey, Calif.
FREQUENCY RESPONSE ANALYSIS AND DESIGN OF SINGLE-VALUED NONLINEAR SYSTEMS USING THE PARAMETER LANE
John Philip Davis (M.S. Thesis) Jun. 1969 178 p refs
(AD-6911384) Avail: CFSTI CSCL 12/1

Frequency response techniques are a valuable tool in the analysis and synthesis of linear systems. Extension of these techniques is made to analyze and design systems with a single-valued nonlinear element. The relationship between the characteristics of a nonlinear element and the frequency of the system is developed by simple calculations and a digital computer program. Author (TAB)

N69-40809# Houston Univ., Tex. Mechanical Engineering Dept.
INVERSE PROBLEMS IN PARTIAL DIFFERENTIAL EQUATIONS
Dennis L. Luckinbill and Bart Childs Aug. 1968 101 p
(Contract N00014-68-A-0151)
(AD-691390; RE-1-68) Avail: CFSTI CSCL 12/1

A procedure for identification in partial differential equations is described and illustrated by the Laplace equation and the unsteady heat conduction equation. The procedure for solution involves the substitution of difference operators for the partial derivatives with respect to all but one of the independent variables. The linear boundary value problem is solved by superposition of particular solutions. For non-linear boundary value problems which arise from the original form of the equation or from the identification procedure, a Newton-Raphson-Kantorovich expansion in function space is used to reduce the solution to an iterative procedure of solving linear boundary value problems. For the problems considered, this procedure has proven to be effective and results in a reasonable approximation to the solution of the boundary value problem in partial differential equations. For the identification problem, it is shown that the constant parameters are identified to the same accuracy as the supplementary data used in the identification procedure. Author (TAB)

N69-40818# Institute of Mathematical Science, Madras (India).
GROUP THEORY AND UNITARY SYMMETRY
T. S. Santhanam [1968] 90 p refs
(MATSCIENCE-61) Avail: AEC Depository Libraries: $1.00

The discussion of group theory and unitary symmetry covers elementary particles, the preliminary mathematics, the Lie group representation and Lie algebras, and a review of unitary groups. Also generating functions of classical groups and evaluation of partition functions are discussed. NSA

N69-40834# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
FORTRAN M: PROGRAMMING PACKAGE FOR BAND MATRICES AND VECTORS
James S. Petty Apr. 1969 57 p
(AD-691431; ARL-69-0064) Avail: CFSTI CSCL 9/2

FORTRAN M is a modified FORTRAN language designed to aid in the numerical manipulation of band matrices and vectors. In FORTRAN M, band matrices and vectors may be handled in a manner similar to ordinary matrix algebra. Two FORTRAN M packages and their use are described; one for use with an IBM 7094 II computer and one for an IBM 1620. Each package consists of a programming language, a translator program and a set of subroutines. Appendices contain an illustrative example and source lists of the translators and subroutines. Author (TAB)

N69-40842# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
NONRELATIVISTIC TRANSFORMATIONS OF THE COORDINATES AND THE INVARIANCE OF THE NONRELATIVISTIC HAMILTON-JACOBI EQUATION
V. N. Strel'tsov 1969 10 p In RUSSIAN
(JINR-P2-4461) Avail: AEC Depository Libraries

Nonrelativistic transformations of the coordinates: $x' = (x - vt)\,[1 + (1/2)(v^2/c^2)]$; $t' = t\,[1 + (1/2)(v^2/c^2)] - [v/c^2)\,x]$, were considered. It is shown that the conventional nonrelativistic Hamilton-Jacobi equation corresponds to just the given approximation, whereas in the Galilean approximation it is of the type: $\alpha S / \alpha t = 0$. Author (NSA)

N69-40849# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
NONRELATIVISTIC TRANSFORMATIONS OF COORDINATES AND TRANSITION FROM THE KLEIN-GORDON EQUATION TO THE NONRELATIVISTIC WAVE EQUATION
V. N. Strel'tsov 1969 12 p refs In RUSSIAN
(JINR-P2-4462) Avail: AEC Depository Libraries

It is shown that the Schroedinger equation is noninvariant relative to the nonrelativistic transformations of the coordinates. As nonrelativistic limit of the Klein - Gordon equation an expression of the type: $[\psi\,(\alpha^2\psi/\alpha t^2)]^{1/2} - (imc^2/\hbar)\psi = -(i\hbar/2m).\,(\alpha^2\psi/\alpha x^2)$ is proposed which satisfies the mentioned invariance requirement. Author (NSA)

N69-40853# Houston Univ., Tex. Cullen College of Engineering.
IDENTIFICATION OF SYSTEMS
Bart S. Childs Aug. 1969 37 p refs
(Contract N00014-68-A-0151; Proj. THEMIS)
(AD-691391; RE-2-68) Avail: CFSTI CSCL 12/1

The paper is a tutorial discussion of identification problems. The basic principles of one method of identification are discussed.

The method of quasilinearization has been developed by Richard Bellman and Robert Kalaba and others. This method is discussed in some detail with emphasis on programming strategies. These strategies are intended to improve the utility of a general quasilinearization program. Specific strategies are concerned with expansion of convergence space, super-position of particular solutions, and convergence criteria. Author (TAB)

N69-40860# New York Univ., N.Y. AEC Computing and Applied Mathematics Center.
DECAY OF SOLUTIONS OF SYSTEMS OF HYPERBOLIC CONSERVATION LAWS
James Glimm and Peter D. Lax. Apr. 1969. 112 p. refs
(Contract AT(30-1)-1480)
(NYO-1480-115) Avail: CFSTI

We are dealing with a system of two partial differential equations of the form $u_t + f_x = 0$, and $v_t + g_x = 0$, where f and g are functions of u and v subject to the following conditions: the system is hyperbolic, the system is genuinely nonlinear, and the interaction of two shocks of the same family always produces a shock of the same family plus a rarefaction wave of the opposite family. Denote by ϵ the oscillation of the initial data. The initial data need not have bounded total variation. Results are as follows: For epsilon small enough the solution of the initial value problem exists for all positive time. If the initial data are periodic the solution decays like $1/t$. The proofs are based on inequalities which take into account the interaction of shock waves and rarefaction waves of the same family. The estimates prove that such interactions must occur and that when they do occur they lead to decay in the solution. Author (NSA)

N69-40864# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
COMMENTS ON THE DISTRIBUTION OF INDICES OF DIVERSITY
L. R. Shenton, K. O. Bowman, and K. Hutcheson. 1 Jul. 1969. 57 p. refs
(Contract W-7405-eng-26)
(CTC-14) Avail: CFSTI

Several measures of diversity in populations have been used by ecologists and information theoreticians. For example, ecologists have used Shannon's information statistic $h_s = -\sum p_i \ln p_i$. Simpson's distance measure $h_{su} = \sum p_i^2$ (or its root), and Brillouin's combinatorial type measure $h_b = n^{-1} \ln n!/n_1! \ldots n_k!$. Distributional properties of these are studied from three points of view; (a) the exact distribution is found by sample configuration enumeration, (b) approximate distributional properties are found through Monte Carlo simulations, (c) asymptotic moments are developed and their uses in assessing departures from normality considered. It is brought out that no one method is adequate for the parameter space in general, and that asymptotic moment developments are generally markedly unstable. However, the distribution of h_s is remarkably close to normal when the category probabilities follow MacArthur's model. The study illustrates methods of gaining insight into some of the complex distributional problems associated with multinomial structures. Author (NSA)

N69-40866# Atomic Energy Establishment, Winfrith (England). General Reactor Physics Div.
ESTIMATION OF COLLISION PROBABILITIES IN COMPLICATED GEOMETRIES
M. J. Roth. Apr. 1969. 16 p. refs
(AEEW-M-857) Avail: CFSTI; UK: 1s 3d

A method of synthesizing solutions to reactor physics problems with complicated geometries is described. Collision probability matrices are obtained for simple units and, then, put together to arrive at an approximate expression for the complicated geometry. The only assumption made is that of uniform flux which is also isotropic at the boundary. Numerical results from a WIMS computation are included to illustrate the method. NSA

N69-40910# RAND Corp., Santa Monica, Calif.
INVARIANT IMBEDDING AND OPTIMAL CONTROL THEORY
R. Kalaba and R. Sridhar. Mar. 1969. 19 p. refs
(Contract F44620-67-C-0045)
(AD-686726; RM-5917-PR) Avail: CFSTI: CSCL 12/2

The paper gives a new derivation of an initial-value problem whose solution furnishes the extermal arc of the optimal control problem. No use is made of the Euler-Lagrange equations, the transversality conditions, or the Bellman-Hamilton-Jacobi theory. It is shown in a straightforward manner that the solution of the initial value problem satisfies the Euler-Lagrange equation and the transversality conditions. In addition, the numerical solution of the initial-value problem often avoids the stability problems associated with the numerical solution of the boundary-value problem. Author (TAB)

N69-40944*# Brown Univ., Providence, R.I. Center for Dynamical Systems.
PROBABILITY LIMIT THEOREMS AND THE CONVERGENCE OF FINITE DIFFERENCE APPROXIMATIONS OF PARTIAL DIFFERENTIAL EQUATIONS
Harold J. Kushner. [1968] 45 p. refs
(Grants NGL-40-002-015; AF-AFOSR-67-0693-A; NSF GK-2788)
(NASA-CR-106403) Avail: CFSTI: CSCL 12A

Certain convergence theorems (for probability measures on spaces of continuous functions) are applied to a problem in the convergence of finite difference approximations to partial differential equations. Author

N69-40953# Naval Post Graduate School, Monterey, Calif.
PARAMETER PLANE SINGULAR LINE SYSTEMS
Paul Roper Jeffers (M.S. Thesis). Dec. 1968. 65 p. refs
(AD-691387) Avail: CFSTI: CSCL 12/2

Derivation and methods for the proof of existence of singular lines on the parameter plane is presented. A method is derived for producing singular line systems. Several systems are designed and evaluated using this technique. Author (TAB)

N69-40954# Naval Postgraduate School, Monterey, Calif.
A TEST OF THE HYPOTHESIS THAT THE SECOND PARAMETERS OF PAIRED BINOMIAL DISTRIBUTIONS ARE PAIRWISE EQUAL
Gene Arthur Venzke (M.S. Thesis). Dec. 1968. 72 p. refs
(AD-691389) Avail: CFSTI: CSCL 12/1

A test of the hypothesis that the second parameters (success probabilities) of a number of paired binomial distributions are pairwise equal is derived under weak assumptions. Computer codes necessary to implement the procedure are given and a case study is used to demonstrate the procedure. Some other procedures for testing the same hypothesis under stronger assumptions are discussed and compared with the given procedure. A rapid approximate procedure is also given. Author (TAB)

N69-40963# Houston Univ., Tex. Mechanical Engineering Dept.
NUMERICAL SOLUTIONS OF DIFFUSION TYPE EQUATIONS
John L. Bryan and Bart Childs. Jun. 1969. 62 p. refs
(Contract N00014-68-A-0151)
(AD-691399; RE-4-69) Avail: CFSTI: CSCL 12/1

A method of obtaining numerical solutions of a general class of boundary-value problems governed by the two-dimensional diffusion equation is investigated. The method employs a partial discretization of independent variables to reduce the problem of partial differential equations to a sequence of related boundary-value problems governed by a system of linear second-order ordinary differential equations. The generality of the method is demonstrated by applications to example problems involving both regular and irregular boundaries with boundary conditions of a general type. Application of separation of variables techniques to obtain

closed-form solutions of a certain class of problems is presented and the results are used to indicate the accuracy of the method. An investigation into the stability characteristics of the resulting system of ordinary differential equations is also presented. It is concluded that the method appears to show promise as an easily implemented numerical method but that the full potential of the approach will not be realized until significant advances have been made in both computing hardware and software. Author (TAB)

N69-41017 Illinois Univ., Urbana.
THE STABILITY OF MOTION IN A PERIODIC CUBIC FORCE FIELD
Curtis Arthur Wagner (Ph.D. Thesis) 1968 154 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-1478

The object of this research has been to investigate numerically the possible existence of closed, invariant regions of stability for solutions of a particular nonlinear differential equation. The Illiac II computer has been utilized for an accurate study of the stability properties of solutions of the cubic equation. This nonautonomous equation has the form $d^2X/dt^2 + p(t)\ X^3 = 0$, where p(t) is a periodic square-wave function of time with magnitude p_0 and period τ. This equation can be integrated piecewise in terms of Jacobian elliptic functions, and hence is suitable for a high-speed digital computer. Not relying on numerical integration techniques allows us to perform many highly accurate computations over thousands of periods of τ. For fixed values of p_0 and τ the motions in a global neighborhood of a particular solution with period 11τ which has an elliptic fixed point on the X-axis were studied. Initial exploratory calculations using numerical integration revealed a region associated with fixed points of period 55τ which apparently did not allow any of its interior points to escape to infinity.
Dissert. Abstr.

N69-41023# New York Univ., N.Y. Courant Institute of Mathematical Sciences.
A FINITE DIFFERENCE METHOD FOR THE SOLUTION OF FREE BOUNDARY PROBLEMS
Eugene Block May 1969 123 p refs
(Contract AT(30-1)-1480)
(NYO-1480-116) Avail: CFSTI

The systematic iterative procedure described yields finite difference solutions to steady free-boundary problems of plasma physics and fluid dynamics. By application of the method of steepest descent to minimize certain energy functionals connected with conformal mapping and free-boundary problems, a system of artificially time-dependent equations is produced, which converges to a steady state as the time parameter goes to infinity. The solution is obtained in a parameter goes to infinity. The solution is obtained in a parametric form in which the physical plane is the conformal image of a fixed rectangle. The use of a fixed rectangle as the parameter domain enables one to treat effectively the difficulties engendered by the singular behavior of the stream function at the point of separation between the fixed and free boundaries. As a result the scheme can be made convergent to second order in the mesh width h. Author (NSA)

N69-41027 Missouri Univ., Rolla.
SIGNAL THEORETIC CHARACTERIZATION OF A FUNCTION USING POSITIVE EXPONENTIAL BASIS FUNCTIONS
James Julius Baremore (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-2257

The characterization obtains the coefficients in the expansion by processing the input waveform, in real time, through a system of three terminal passive RC filters. The outputs of the filters are sampled periodically, and the coefficients of the basis function expansion in that interval are related to these values. The basis functions result from an exponential transformation applied to the Legendre polynomials and are orthogonal in time over the sample interval. The basis functions and the resulting reconstruction appear as summations of positive exponential terms. Since different signals may require different sampling intervals and/or different number of terms in their orthogonal expansions, the input waveforms were classified in the time domain by two methods: (1) A graphical method in which the worst case input to the system is bounded by simple test functions is used. The shortest duration of the resulting test functions gives the sample interval. The technique is easy to use, but gives conservative error estimates. (2) The input waveform is also classified in terms of the pole locations of the Laplace-transformed input function. Using conventional time domain synthesis techniques, the pole locations of the transformed input function can be located in the complex-S plane. Bounding these poles by circles, with center at the origin of the S plane, will give the maximum signal reconstruction error for a given number of filters. This method is more analytical than the first method, although more work is required to find the pole locations. Dissert. Abstr.

N69-41041# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
SOME DISTRIBUTION AND MOMENT FORMULAE FOR THE MARKOV RENEWAL PROCESS
A. M. Kshirsagar and R. Wysocki Jun. 1969 16 p refs
(Contract N00014-68-A-0515)
(AD-691297; TR-36) Avail: CFSTI CSCL 12/1

A Markov Renewal Process M. R. P. is a Markov chain, in which the time taken to move from one state to another is not fixed, but is a random variable, whose distribution depends on the two states between which the transition is made. If F sub IJ T denotes the number of transitions for these moments, when T is large, are also derived. These expressions are in terms of the basic quantities P sub IJ, Q sub IJ of the M. R. P. and not in terms of recurrence times, as obtained by Pyke, and hence more suitable. Distributions, moments, and cross moments of cumulative processes associated with the M. R. P. are also derived.
Author (TAB)

N69-41077 Wisconsin Univ., Madison.
DIFFERENTIAL AND TOPOLOGICAL BRAIDS
Frank Arvey Wattenberg (Ph.D. Thesis) 1968 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-14032

This thesis is devoted to the study of braid theory in the differentiable and topological categories. A definition is given of braid groups for very general spaces, although most of the work done is for manifolds. An elementary proof is given that in the differentiable category the braid groups based on diffeomorphisms with compact support are isomorphic to those based on diffeomorphisms with arbitrary support. The differentiable braid group is then computed for braids based on diffeomorphisms with compact support and hence, also for braids based on diffeomorphisms with arbitrary support. A number of techniques are developed which are applicable to more general situations. Dissert. Abstr.

N69-41080# Stanford Univ., Calif. Stanford Electronics Labs.
PROLATE SPHEROIDAL WAVEFORM EXPANSIONS FOR COMPUTER AIDED SIGNAL PROCESSING
Jerome Charles Woodward May 1969 127 p refs
(Contract Nonr-225(83))
(AD-691439; SU-SEL-69-039; TR-6560-18) Avail: CFSTI CSCL 12/1

The report describes a practical method for computing direct and inverse Fourier transforms based on finite length records taken from data waveforms (which may have infinite length). A search for a method of improving the accuracy of signal processing operations has yielded a powerful series expansion technique using prolate spheroidal waveforms which has application not only to signal theory but to other fields where the Fourier transform is used.
Author (TAB)

N69-41101# Rensselaer Polytechnic Inst., Troy, N.Y.
A NUMERICAL SOLUTION OF THE TIME DEPENDENT DP SUB L APPROXIMATION
H. N. Knickle and P. B. Daitch [1969] 5 p Presented at the 15th Ann. Meeting of Am. Nucl. Soc., Seattle, Wash.
(RPI-328-157; CONF-690609-16) Avail: CFSTI

A numerical solution for the time dependent transport equation for fast pulsed assemblies is given; the solution is accurate in the time range from fractions of a nanosecond to milliseconds. An implicit difference scheme is used to conserve spatial gradients with increasing time. Stability and convergence of the numerical solution are evaluated. NSA

N69-41104# Technische Hochschule Munchen (West Germany).
COMPLETE SOLUTION OF A RELATIVISTIC BETHE-SALDETER EQUATION FOR BOUND CONDITIONS [VOLLSTAENDIGE LOESUNG EINER RELATIVISTICHEN BETHE-SALPETER-GLEICHUNG FUER GEBUNDENE ZUSTAENDE]
Ernst Zur Linden (Ph.D. Thesis) 1969 60 p refs In GERMAN
Avail: CFSTI

The complete solution for the relativistic scalar Bethe-Salpeter equation of bound conditions in wave functions uses exact numerical calculations to determine mass proportions and the Wick-Cutkosky model in form of exponential series to obtain the overall energy and its coefficients. Extension to non-physical rotating impulses is used to obtain Regge trajectories; comparison of the Wick-Cutkosky model with the case where the exchanged particle posses the mass $\mu \neq 0$ clarifies the importance of the quantum numbers introduced by Cutkosky. Transl. by G.G.

N69-41144# Grumman Aerospace Corp., Bethpage, N.Y.
OPTIMAL STOCHASTIC CONTROL OF CONTINUOUS SYSTEMS WITH NOISY MEASUREMENTS
Richard Gran Aug. 1969 55 p refs
(ADR-06-05-69.3) Avail: CFSTI CSCL 12A

The present investigation has been motivated by the problem of the time optimal control of linear systems where there are noisy measurements and where the system itself is perturbed by noise. This is generally the case in realistic problems. The difficulties encountered in this problem are:(1) the control itself is not linear; (2) a tractable definition of minimum time must be formulated (i.e. a time must be considered which can be derived by the controller); and (3) an algorithm must be developed which would lead to a useful solution. In the past, an approximation to the solution of this problem has used the separation approach. That is, the optimal mean square estimator (Kalman filter) is derived, and the system is then controlled as if the Kalman filter were the actual system. The results of this study show that the separation approach is valid for this time optimal problem and also for a wide class of free terminal time problems. The proof of this result uses the stochastic maximum principle, and the properties of the differential generators of the system and filter. Conditions are derived which show when the optimal control is the result of cascading the Kalman filter with the noise free controller, the time optimal control of the single axis of a spacecraft is shown to satisfy this condition. This study shows the theoretical basis of a new and novel design approach for optimal stochastic control systems such as is required for precision pointing of satellites. The application of these results to a specific satellite problem is described. Author

N69-41152*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STUDIES IN SYSTEM SIMULATION
R. Saeks (Notre Dame Univ.) 27 Aug. 1969 43 p refs
(NASA-TM-X-53868) Avail: CFSTI CSCL 12A

The results of three mathematical studies of the feasibility of various methods of large-scale digital system simulation are reported. Specific studies deal with the effects of applying numerical techniques directly to the components of a system, approximation techniques for reducing the order of subsystems, and data compression techniques for the computer storage of the large topological matrices encountered in system simulation. Author

N69-41153# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
CORRELATIONS IN ISING FERROMAGNETS
J. Ginibre 1969 26 p refs Presented at Cargese Summer School in Statist. Mech., July 1969
(Rept-69/50) Avail: CFSTI

Some inequalities on the correlation functions of Ising ferromagnets are presented. A general formalism is described from which the first inequality theorem follows. A statement and two different proofs of the second and more profound inequality theorem is given, as well as a third. Some applications of the inequalities and a brief description of open questions and possible extensions, in particular to quantum spin systems are also presented. Author

N69-41154# Saskatchewan Univ., Saskatoon. Div. of Control Engineering.
SENSITIVITY METHODS IN THE DESIGN OF ADAPTIVE CONTROL SYSTEMS
P. N. Nikiforuk and S. Tsiao [1968] 11 p refs
Avail: CFSTI

Sensitivity methods may be applied to the solution of problems arising in the design of self adaptive control systems. The synthesis of a stable on line adaptive structure employing a sensitivity method is developed for a linear slowly timevarying single input – single output system. Sensitivity coefficients are derived for this system, followed by the establishment of a relationship between a Lyapunov function and the sensitivity coefficients. Since the latter are of high order, a technique is then evolved which permits the synthesis to be accomplished by the use of approximate first order sensitivity coefficients. Author

N69-41200 Washington Univ., St. Louis, Mo.
INITIAL VALUE PROBLEMS ASSOCIATED WITH BER BURGERS' EQUATION
Robert Aubrey Walsh (Ph.D. Thesis) 1968 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-2448

It is the purpose of this dissertation to investigate conditions under which initial value problems associated with the quasi-linear parabolic partial differential equation (called Burgers' Equation) $u_t(x,t) = \delta u_{xx}(x,t) - u(x,t)u_x(x,t)$; $t > 0$, $a \leq x \leq b$ $\delta > 0$ where δ, a, b, are constants, possess an analytic solution. The presentation will discuss the difficulties involved in achieving analytic solutions for typical problems, mathematical properties of the solutions, and applications. Dissert. Abstr.

N69-41201# Centre National de la Recherche Scientifique, Marseilles (France). Centre de Physique Theorique.
POTENTIAL SCATTERING IN THE LIMIT OF LARGE COUPLING
K. Chadan and E. Mourre [1969] 31 p refs
(Rept-69/P.291) Avail: CFSTI

Presented is a new method for the study of analytic properties of various quantities occuring in potential scattering, such as the wave-functions and the Jost functions. The method is based on a transformation of the Green's function of the reduced radial Schrodinger equation, and on some special properties of the Hankel functions, namely the location of their zeros and the behaviour of their moduli. Although the method seems to be adapted for studying other analytic properties, the main concern here is analytic and asymptotic properties with respect to the coupling constant g. Author

N69-41203 California Univ., Riverside.
RING THEORETIC LATTICE MODULES AND THE HILBERT POLYNOMIAL

David Gilbert Whitman (Ph.D. Thesis) 1968 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-2663

Let R be a commutative ring with identity and let N be a unitary R-module. The lattice of submodules of N, denoted L(N), has been the object of intensive study for many years. There are four basic operations defined on L(N): join, meet, product, and residual division. By picking certain properties which these operations satisfy and setting up these properties as axioms a new mathematical object is defined. The object thus defined is called a ring-theoretic L-module, where L is a principally generated multiplicative lattice. It is shown that ring theoretic L-modules provide an effective abstraction of L(N). Dissert. Abstr.

N69-41209*# Ohio Univ., Athens. Dept. of Electrical Engineering.
ACTIVE FUNCTION SYNTHESIS UTILIZING MODELING AND SCALING PROCEDURES Final Technical Report, 1 Oct. 1968 - 30 Sep. 1969
Wai-Kai Chen 30 Sep. 1969 8 p refs
(Grant NGR-36-009-012)
(NASA-CR-106453; EER-10-25) Avail: CFSTI CSCL 12A

The objective is to increase the usefulness and effectiveness in applying dimensional analysis to modeling and scaling procedures used by aerospace and electronics engineers. Two complete bibliographies on the theory and applications of dimensional analysis were assembled during the literature search phase. The study of dimensional analysis demonstrated that a complete set of B-numbers (pi-numbers) itself contains enough information as to which linear combinations should be formed to obtain the optimized ones. Based on this property, an efficient algorithm was developed which generates a complete optimized set of B-numbers from any complete set of B-numbers. The algorithm may also be used to generate all the complete optimized sets of B-numbers, and it is non-exhaustive and efficient and is readily adaptable for a digital computer. Author

N69-41248*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
ON APPROXIMATION OF FUNCTIONS, TOPOLOGICAL MAPPINGS AND NONLINEAR FEEDBACK CONTROL SYSTEMS
Michael Athans, Atif S. Debs, and Keith M. Joseph Jun. 1969 92 p refs
(Grants NGL-22-009-124; NSF GK-2645; MIT Proj. 76265; MIT Proj. 71139)
(NASA-CR-106398; ESL-R-389) Avail: CFSTI CSCL 12A

The use of topological mappings in the design of optimal nonlinear feedback control systems is investigated. Special emphasis is given in the structure and properties of Kolmogorov - Lorentz - Sprecher type of transformations and on Hilbert topological mappings. It is determined that the Hilbert mapping is the only one capable of being expressed in a binary format and hence, compatible with digital computers. It is further established that the n dimensional Hilbert mapping and its inverse can be computed by a simple recursive algorithm in a digital computer requiring virtually no data storage space. The computational algorithm for the n dimensional mapping is presented and the various required operators are defined and their implementation discussed. A two-dimensional example of the representation is presented. Author

N69-41258# Ohio State Univ., Columbus. Computer and Information Science Research Center
MINIMUM COVERS OF FIXED CARDINALITY IN WEIGHTED GRAPHS
Lee J. White Mar. 1969 17 p refs
(Grant NSF GN-534.1)
(PB-183737; TR-69-2) Avail: CFSTI CSCL 12A

Given a weighted graph, a method is discussed for obtaining minimum covers of specified cardinality. It is shown that the family of minimum covers of varying cardinality is related to the minimum spanning tree of that graph. Author (USGRDR)

N69-41259 Los Alamos Scientific Lab., N.Mex.
THE DIRECT SOLUTION OF THE DISCRETE POISSON EQUATION ON A RECTANGLE
Fred W. Dorr 15 May 1969 13 p refs
(Contract W-7405-eng-36)
(LA-4132) Avail: CFSTI

A survey of direct methods for solving finite difference analogs of the Poisson equation on a rectangle is presented. These methods can be considerably faster than iterative methods. Author (NSA)

N69-41260 Brandeis Univ., Waltham, Mass.
REDUCING THE NUMBERS OF FOLD CURVES AND CUSPS OF GENERIC MAPS
Penelope Ann Nevulis (Ph.D. Thesis) 1968 176 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-2058

If V and M are orientable, real, C^∞ manifolds with V compact, dim V = n $\geq$ 2, and dimM = 2, and if f:V$\rightarrow$M is a generic map, then there exists a generic map g homotopic to f such that g has at most one cusp if n > 2 and at most two cusps on each fold curve of g if n = 2. It is proven that the results are true whether or not V and M are orientable and results are given for the case when n = 2; that is to prove that when n = 2 the number of cusps can be reduced to one, via homotopy. The proof is straightforward. The same procedure as was used to prove the result when V and M are orientable is essentially followed with the appropriate modifications put in as needed. A series of new homotopic techniques is developed, which involve adding as well as eliminating cusps. These new techniques turn out to have value other than just for completing the result when n = 2 and hence are developed both for the case when n = 2 and for the case when n > 2. In particular, with the help of the new techniques, statements can be made about reducing the number of fold curves, via homotopy, of a generic map f as well as eliminating the cusp of f. Dissert. Abstr.

N69-41261 St. Louis Univ., Mo.
BOOLEAN 2: GEOMETRY
Hubert Joseph Ludwig (Ph.D. Thesis) 1968 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-358

A study of Boolean geometry is given by considering a Boolean algebra $\mathcal{B}$ and a mapping ρ of $\mathcal{B}\times\mathcal{B}$ into $\mathcal{B}$ defined for elements a and b of $\mathcal{B}$ by $\rho(a,b) = ab' + a'b = (ab + a'b')'$. The mapping ρ has properties analogous to those of a metric and the space $(\mathcal{B},\rho)$ is referred to as an autometrized space. The space $(\mathcal{B},\rho)$ is called Boolean 1-geometry. Betweenness in $(\mathcal{B},\rho)$ is defined by B(a,b,c) if and only if $\rho(a,c) = \rho(a,b) + \rho(b,c)$, $a \neq b \neq c$, and it is shown that B(a,b,c) is equivalent to b(a+c) = b + ac, $a \neq b \neq c$. It is shown that B(a,b,c) is also equivalent to acb' + a'c'b = 0, $a \neq b \neq c$. Using these two equivalences the betweenness relation in $(\mathcal{B},\rho)$ is studied. The mapping α of $\mathcal{B}\times\mathcal{B}\times\mathcal{B}$ into $\mathcal{B}$ defined, for elements a, b and c of $\mathcal{B}$, by $\alpha(a,b,c) = (abc + a'b'c')'$ is considered and properties of the mapping are shown. The mapping α has properties analogous to those of a $\mathcal{B}$-2-metric and hence the space $(\mathcal{B},\rho,\alpha)$ is referred to as a 2-autometrized space. The geometry of $(\mathcal{B},\rho,\alpha)$ is called Boolean 2-geometry. The results of applying the mapping α to various combinations of sums, products, distances and areas of elements of $\mathcal{B}$ are determined. Dissert Abstr.

N69-41263# California Univ., Los Angeles.
A BIFURCATION PROBLEM FOR A FUNCTIONAL DIFFERENTIAL EQUATION OF FINITELY RETARDED TYPE: SUMMARY OF RESULTS

Nathaniel Chafee 1969 9 p refs
(Contracts NONR-233(76); DA-31-124-ARO(D)-270; Grants NSF GP-4632; AF-AFOSR-942-65)
(AD-690830) Avail: CFSTI CSCL 12/1

The theory of integral manifolds for ordinary differential equations is discussed. Functional differential equations with values in a real Euclidean space are considered for the existence of a matrix whose components are real valued functions of bounded variations. A theorem concerning the functional differential equation is given with necessary assertions showing that the origin can be regarded as a saddle point for the functional differential equation. B.G.D.

N69-41292# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Building Research.
THE SUPERPOSITION OF TWO DIMENSIONAL CENTRES OF AXISYMMETRY
N. I. Robinson and J. F. Brotchie 1969 13 p refs
(PB-183765; TP-24) Avail: CFSTI CSCL 12A

The superposition of zero-order axisymmetric potentials in a polar-symmetric manner leads to a simple geometrical representation of higher order potentials. A physical interpretation of the lower order potential components is made in the case of a thin flat plate.
Author (USGRDR)

N69-41306# Iowa Univ., Iowa City.
ON THE AUTOMORPHISM GROUP OF PRODUCT AUTOMATION
Bruce H. Barnes Aug. 1969 14 p refs
(Contract N00014-68-A-0500)
(AD-691757; TR-16) Avail: CFSTI CSCL 12/1

In a recent article, Weeg asked the following question: Given two arbitrary finite groups H and K of regular permutations of finite sets is it possible to find two strongly related finite automata A and B such that the groups of automorphisms G(A) is isomorphic to H, G(B) isomorphic to K and G(A) x G(B) isomorphic to G(A x B). Pickertt has given a constructive answer to this question. His solution, however, uses an excessive number of inputs. In this paper another constructive approach is given to this problem. This new approach uses considerably smaller number of inputs.
Author (TAB)

N69-41324 Wisconsin Univ., Madison.
TOPOLOGICAL LATTICE ORDERED GROUPS
Robert Lewis Madell (Ph.D. Thesis) 1968 98 p
Avail: Univ. Microfilms HC $5.00/Microfilm $3.00 Order No. 68-14008

A topological lattice ordered group (notation: tl-group) is a triple $(G, \leq, T)$ (henceforth denoted simply by G) such that: (1) $(G, \leq)$ is a lattice ordered group (notation: l-group); (2) (G, T) is a topological group; and (3) $(|G|, \leq, T)$ is a topolotical lattice, where $|G|$ denotes the underlying set of the group G. It is easy to show using simple properties of l-groups that there are no non-trivial compact tl-groups and that the homotopy groups $\Pi_n(G)$, $n \geq 1$, are all trivial. Let $T_1(G)$ denote the intersection of the topological closures of the minimal prime convex l-subgroups of G. Then $T_1(G)$ has the usual radical properties and the following results may be obtained. Dissert. Abstr.

N69-41329# Joint Publications Research Service, Washington, D.C.
THEORY OF QUESTIONNAIRES AND THE PROBLEMS OF TECHNICAL DIAGNOSTICS
P. P. Parkhomenko *In its* Papers presented at IFAC Session in Warsaw 3 Oct. 1969 p 32-43 refs (See N69-41326 24-09)
Avail: CFSTI

The problem of constructing optimum experiments in a finite set of events is examined from the standpoint of interrogation theory. Specifically, an analysis is made of the links of the latter technique with the dynamic programming and the branch-and-bound methods. Investigations of a particular type of questionnaire, in which the questions are of equal value, form the basis of the computations. A.C.R.

N69-41332# Montpellier Univ. (France).
BROKEN SYMMETRY SUM RULES AND RHO - OMEGA MIXING
F. M. Renard Sep. 1969 11 p refs
(PM/69/7) Avail: CFSTI

Shown is how broken SU_3 with U-spin invariance of the E.M. interactions or tadpole dominance for the $|\Delta I| = 1$ mass differences or generalized Weinberg sum rules may agree to predict a $\rho - \omega$ missing effect which is consistent with experimental results.
Author

N69-41333 Michigan Univ., Ann Arbor.
A THEORY OF AXIOM SYSTEMS
Oswald Petrucco (Ph.D. Thesis) 1968 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-2272

Given an axiom system W, it is interesting to determine any valid implication which might exist between the members of W and in constructing an example whenever one wishes to illustrate that a certain implication is not a true statement. Working in this fashion two families of objects are obtained--one consists of the valid implications associated with the axioms of W while the other collection is made up of examples to be used to sift out the implications which are not true statements. However, the corresponding set of examples obtained in this way may increase very rapidly with the addition of new axioms to our system W, so if the original system W initially contains a large number of axioms the corresponding set of examples may be so large that it is no longer economical to write down all of them. It is shown that under certain conditions it is not really necessary to find all the examples associated with W, rather it is sufficient and more economical to construct an appropriate minimal set and then to use this minimal set to generate the remaining examples associated with W. Dissert. Abstr.

N69-41336# Union Carbide Corp., Oak Ridge, Tenn.
GEODESIC PATHS ON SURFACES OF REVOLUTION: A COMPUTER AIDED FILAMENT WINDING DESIGN PROGRAM
T. W. Bookhart and A. H. Fowler 20 Nov. 1968 90 p refs
(Contract W-7405-eng-26)
(Y-1660) Avail: CFSTI

Fortran computer programs have been written that will determine the geodesic paths on an arbitrary surface of revolution. The programs can also determine the number of circuits of the geodesics necessary to produce a wrap of a specified thickness. This thickness can be for one geodesic or be the cumulative buildup of many geodesics. Once the geodesic paths are determined, thickness profile and helix angle plots are produced. In addition, routines are available for plotting the geodesic paths on the developed surface giving a two-dimensional picture of the paths on the surface.
Author (NSA)

N69-41343 California Univ., Los Angeles.
THE p-ADIC DOMAINS OF ANALYTICITY
Joseph Elhanan Motzkin (Ph.D. Thesis) 1968 57 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-1119

Described are the sets W in ultrametric space such that for any $a \in W$ the set of distances from a to the points of W is of finite cardinality, and assign to each a weighted tree (a partial ordering with a number associated with every adjacent pair of elements). Established are the admissible p-adic domains of analyticity. It is shown that to each domain there is assigned a weighted tree which is invariant under linear fractional maps and a simplified weighted tree which is invariant under homomorphisms.
Dissert. Abstr.

N69-41358 Auburn Univ., Ala.
A MONTE CARLO INVESTIGATION OF A FREQUENCY FUNCTION RELATED TO RANK CORRELATION
Saeed Maghsoodloo (Ph.D. Thesis) 1968 58 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-2245

In this thesis two principal developments are presented. Firstly, a combinatorial approach to $\phi_N(S)$, with fixed N and $0 \leq S \leq 18$, was exhaustively investigated. Although algebraic expressions were obtained, it was found that the complications proliferated at such speed with increasing S that the method used became unmanageable for $S > 18$. There was no inductive process for relating $\phi_N(S_0)$ to $\phi_N(S)$ for $S < S_0$ found. Secondly, $\phi_N(S)$ was obtained for $N \leq 10$ by Monte Carlo methods using a high-speed computer. These results were then used to study the approach of the asymptotic distribution $g_N(r)$, to the function $f_N(r)$. It was concluded that the asymptotic distribution was a satisfactory approximation for $N \geq 20$. Dissert. Abstr.

N69-41392 Northwestern Univ., Evanston, Ill.
CONES AND HOMOTOPY IN CATEGORIES
J. Arthur Seebach, Jr. (Ph.D. Thesis) 1968 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-1940

Following an introductory section in which notation and certain general results are established, the notions of cylinders and homotopy are introduced as generalizations of the similar topological concepts. A cylinder for a category α is a quadruple (Z, i_0, i_1, p), where Z is an endofunctor of α, i_0 and i_1 are natural transformations from the identity functor on α to the functor Z, and p is a natural transformation from Z to the identity on α such that $p \circ i_0 = p \circ i_1 = Id$. The obvious generalization to morphisms of the definition of homotopy for maps using a cylinder is given. In general, a homotopy on a category α is defined to be any functor $F: \alpha \to \beta$ which is one to one on objects. If F is onto we call β a homotopy category for F on α. Thus a homotopy is treated as an equivalence relation on the morphisms of α which is compatible with composition. Several examples, including some new ones, of homotopies are given. Dissert. Abstr.

N69-41397 European Organization for Nuclear Research, Geneva (Switzerland).
LAPLACE TRANSFORM
K. S. S. Koelbig 22 Jul. 1969 163 p refs
(CERN-69-20) Avail: Issuing Activity

The Laplace transform is defined as a transform which relates a certain function F(x) to another function f(y) by means of a definite integral. Under certain assumptions another connection exists between the two functions F(x) and f(y), called the inverse of the integral transform. Using the original equation, tables and rules can be constructed for the Laplace transform of operations. These transforms are also applied to derive ordinary differential equations, difference equations, and partial differential equations. Tables can be used to find the inversion of the Laplace transform, i.e., the original function which corresponds to a given image function. When no original function for a given image function exists in the tables, other methods, such as the inverse integral formula, series expansions, and numerical methods, must be applied to find the original function. Finally, the Laplace transform is essential in finding asymptotic relations between original and image functions. R.B.

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also 13 Geophysics, and 30 Space Sciences.

N69-40042# California Univ., Livermore. Lawrence Radiation Lab.
ZONAL GENERAL CIRCULATION MODEL
Michael C. MacCracken 2 Apr. 1969 30 p refs Sponsored by AEC
(UCRL-50594) Avail: CFSTI

The formulation and results of a numerical atmospheric model that is derived from the model of C. E. Leith but that is based on conservation equations having a flux-divergence form are discussed. The model is simplified by assuming that the longitudinal variations of all parameters are zero, a choice that removes meteorological variations but that permits climatic study. Mountains and an energy balance between land and ocean surfaces are included, and both interact with the atmosphere. The results of this two-dimensional model during a two-year real-time run compare favorably with actual climatology; the exceptions can be related to assumptions in the model. The conservation formulation works as expected, and no averaging is necessary to treat the singular points at the poles. Author (NSA)

N69-40119# Oklahoma State Univ., Stillwater. School of Electrical Engineering.
A CENTER FOR THE DESCRIPTION OF ENVIRONMENTAL CONDITIONS. WEATHER PHENOMENA Annual Report
31 Oct. 1968 90 p refs
(Contract DAAB07-68-C-0083; Proj. Themis)
(AD-691122; WP-69-I-4) Avail: CFSTI CSCL 4/2

The program was initiated with a three-phased effort: The development and use of instrumentation to measure the electromagnetic signature of certain weather phenomena (clear air turbulence, thunderstorms, tornadoes) in airborne and ground-based laboratories. The investigation of pattern recognition in the total data acquisition program (sferics, severe weather, existing meteorological information). The data analysis and application to identify indicators for probability of specific phenomena, to determine possible trigger mechanisms which induce the phenomena, and to define techniques for possible modification-abatement, diversion, or intensification of the phenomena. The development of one or more simple airborne instrument packages which can be put in any aircraft for short term measurement of the severity of weather immediately ahead. For addendum, see N69-40120. Author (TAB)

N69-40120# Oklahoma State Univ., Stillwater. School of Electrical Engineering.
A CENTER FOR THE DESCRIPTION OF ENVIRONMENTAL CONDITIONS: WEATHER PHENOMENA, APPENDIX B Annual Report
31 Oct. 1968 274 p refs Addendum to WP-69-I-4; See N69
(Contract DAAB07-68-C-0083; Proj. Themis)
(AD-691123; WP-69-I-4-Add) Avail: CFSTI CSCL 4/2

Contents: Preliminary survey of the present state of knowledge of atmospheric electricity; Preliminary survey of the present state of knowledge on lightning; Preliminary survey on the present state of knowledge of the spectra from lightning produced plasma; Theoretical derivation of atmospheric electrical properties; and An analysis of charge transport and equilibrium in the global atmosphere. For annual report, see N69-40119. (TAB)

N69-40132 National Lending Library for Science and Technology, Boston Spa (England).
CLIMATE FLUCTUATIONS AND THE PROBLEM OF SUPER-LONG-RANGE FORECASTING (20-30 YEARS)
B. L. Dzerdeevskij [1969] 29 p refs Transl. into ENGLISH from Akad. Nauk, Izv., Serv. Geog. (Moscow), no. 5, 1968 p. 43 - 55
(NLL-M-7660-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The possibility of giving super-long-range (20 to 30 years) forecasts of the general character of the climatic regime is

discussed on the basis of the investigation of the circulation of the atmosphere over the Northern Hemisphere and short-period fluctuations of climate. A forecast given for the current circulation and climatic epoch (sixties and seventies of the 20th century) is examined. Author

N69-40150# Institut Royal Météorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Jul. 1969 [OBSERVATIONS CLIMATOLOGIQUES]
1969 15 p In FRENCH and DUTCH
Avail: CFSTI

Data derived from climatological observations made in Uccle (Belgium) during July 1969 are presented. ESRO

N69-40173 National Lending Library for Science and Technology, Boston Spa (England).
AN ASSESSMENT OF THE EFFECTIVENESS OF SYNOPTIC CRITERIA FOR THE EXISTENCE OF CLEAR AIR TURBULENCE
A. A. Vasilev 20 Jul. 1969 12 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Cent. SSSR, Gidromet. (Leningrad), no. 35, 1968 p 29-35
(NLL-M-7732-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

An analytical method for squaring off turbulent and nonturbulent areas in the upper troposphere is used to test the predictive ability of synoptic criteria. Four observation series were used to determine the frequency of turbulent squares, the frequency of nonturbulent squares, and the probability of bumpiness for 11 synoptic models. Statistical distributions of these frequencies revealed that none of the synoptic models was adequate to forecast turbulence; morphological criteria were essential for this achievement. Findings are (1) bumpiness zones produced by turbulence could develop in any of the synoptic criteria, (2) turbulence is observed most frequently in a diffluent contour zone, on the cyclonic side of a jet stream, or the axis of a trough, and formed in ridges almost as often as in troughs. (3) Bumpiness formation is greatest in troughs, and sometimes unassociated with any pressure field characteristics, but instead with vertical wind shear zones. Synoptic and quantitative criteria combined were recommended in the analysis of bumpiness. M.H.E.

N69-40216 National Lending Library for Science and Technology, Boston Spa (England).
ON SOME SPECIAL FEATURES OF THE RELATIONSHIPS BETWEEN PROCESSES IN THE OCEAN AND IN THE ATMOSPHERE
S. T. Pagana 20 Jul. 1969 9 p refs transl. into ENGLISH from Glav. Uprav. Gidromet. Sluzh., Met. Gidr. (Leningrad), no. 2, 1968 p 35-39
(NLL-M-7719-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

An asynchronous relationship between the ocean and atmosphere during the warm half of the year is considered, especially the mechanism by which it is produced. Values of α_1 at 500 mb were analyzed. The time minimum of α_1 in summer gave a general indication of the atmospheric circulation in the northern hemisphere. Development of the synoptic processes from the month with minimim α_1 to September was dependent on the thermal state of the North Atlantic. With a decrease in heat exchange between the ocean and atmosphere, September in European U.S.S.R. was warm; similarly with an increase in heat exchange, September was cold. Simultaneous processes in the atmosphere and ocean are being used to improve the large scale synoptic method of long range weather forecasting. J.A.M.

N69-40227# Naval Postgraduate School, Monterey, Calif.
A THEORETICAL INVESTIGATION OF THE STRUCTURE OF EASTERLY WAVES
Robert L. Newman (M.S. Thesis) Apr. 1969 63 p refs
(AD-691205) Avail: CFSTI CSCL 4/2

A simple two-level numerical model using the quasi-geostrophic forecast equations is developed. Equations are linearized and friction is introduced in the surface layer. Solutions are obtained numerically by using the initial value approach. For each wind profile the growth rate is determined as a function of the wave number. Some observed features of easterly waves are reproduced in the numerical solutions. Author (TAB)

N69-40291# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A NOMOGRAM FOR CALCULATING A WIND ROSE BY THE NORMAL VORTEX LAW
I. G. Guterman 24 Jan. 1969 12 p refs transl. into ENGLISH from tr. Nauchn.-Issled. Inst. Aeroklim. (Moscow), No. 35, 1966 p 88-90
(AD-692135; FTD-HT-1172-68) Avail: CFSTI

The report gives nomograms for calculating a wind rose from eight compass points. Author (TAB)

N69-40294 National Lending Library for Science and Technology, Boston Spa (England).
ON THE INFLUENCE OF RELIEF ON THE FORMATION OF THE TEMPERATURE REGIME IN THE MOUNTAIN REGIONS OF CENTRAL ASIA
O. I. Subbotina [1969] 17 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Cent. SSSR, Gidromet. (Leningrad), no. 1, 1967 p 118-124
(NLL-M-7661-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

The correlationship between the temperature at 52 mountain stations and the temperature in the free atmosphere at the same height is investigated by considering the effects of different relief shapes upon the formation of the temperature regime in mountain areas. Emphasis is placed on large scale orographic effects on the mean temperature field and on temperature distribution in connection with the development of mountain winds inside particular valleys. Calculated correlation coefficients between mountain and radio sonde temperature data establish the increasing effect of the underlying surface on the formation of the temperature field in the free atmosphere. G.G.

N69-40331*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
RESULTS OF PROPAGATION TESTS RUN AT 11 GHz AND 18 GHz ON TWO LINES OF DIFFERENT LENGTH [RISULTATI DI PROVE DI PROPAGAZIONE A 11 GHz E 18 GHz SA DUE COLLEGAMENTI DI DIVERSA LUNGHEZZA]
Giovanni B. Stracca Washington NASA Oct. 1969 80 p refs Transl. into ENGLISH from Italian report
(Contract NASw-1692)
(NASA-TT-F-12545) Avail: CFSTI CSCL 04B

Results of propagation tests conducted during 1967 on a microwave line about 20 km long between Montevecchia and Cassina de' Pecchi at frequencies of 11 and 18 GHz are presented against a background of precipitation data for the area involved, in an effort to correlate rainfall with transmission interruptions. The author concludes that the high attenuation values thus produced in summer render the use of frequencies above 11 GHz impractical unless the storm-affected length of line can be bypassed. Author

N69-40342# Environmental Data Service, Silver Spring, Md.
A NOTE ON CLIMATOLOGY OF THAILAND AND SOUTHEAST ASIA
Harold L. Crutcher, Supatra Bintasant Nash, and Dorothy Kropp May 1969 178 p refs
(EDSTM-10) Avail: CFSTI

A Southeast Asian weather study is presented with emphasis on Thailand. Included are both general and detailed discussions of selected weather phenomena and elements, with accompanying charts and figures. Numerous applications of statistical theory and tests are discussed. Harmonic and spectrum analyses are examined for a number of weather elements. Also included are photographs of a three dimensional topographical map of Southeast Asia and environs upon which upper air wind flow was depicted. Author

N69-40456# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
SEASONAL TRANSITIONS IN THE THERMAL STRUCTURE OF THE MESOPHERE AT HIGH LATITUDES
J. S. Theon and W. S. Smith Sep. 1969 16 p refs submitted for publication
(NASA-TM-X-63702; X-621-69-393) Avail: CFSTI

Twelve acoustic grenade experiments were conducted during the period September 1968 – February 1969. These measurements were intended to monitor the transition in the thermal structure of the mesophere from the persistent summertime case to the dynamic and highly variable wintertime case. The disturbed features typical of winter appeared in the high mesophere in September, and at successively lower altitudes until December, at which time the full winter structure had been established. In early January, a warming at the stratopause began a chain of events which eventually would restore the summertime structure and thus complete the cycle. Author

N69-40458# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.
AN APPROACH TO THE NUMERICAL MODELLING OF CUMULUS-SCALE MOTIONS
Richard Arthur Anawalt (M.S. Thesis) Jun. 1969 102 p refs
(AD-691760) Avail: CFSTI CSCL 4/2

A numerical model which utilizes the isobaric vorticity equation is developed and applied to cumulus-scale data. The model, together with a modified version of the cumulus convection model of Weinstein and Davis, is applied to data obtained from the National Severe Storms Laboratory in Norman, Oklahoma. The calculations yield real time predictions for height, temperature and relative humidity at seven pressure levels, which are then used as input to the cumulus convection model to obtain vertical profiles of various parameters at specified grid points. Some results of the calculations are presented along with suggestions for further testing and improvement. The results indicate that further modifications to the approach used are necessary in order to provide more accurate forecasts. Values of the individual terms in the vorticity equation are presented as computed from the observed mesoscale data. Author (TAB)

N69-40460# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
A COMPREHENSIVE REPORT ON NINETEEN CONDENSATION NUCLEI. PART 1: EQUILIBRIUM GROWTH AND PHYSICAL PROPERTIES
Richard D. H. Low May 1969 571 p refs
(AD-691709; ECOM-5249) Avail: CFSTI CSCL 4/2

The theoretical study of condensation nuclei has been hampered by the fact that one must know the vant Hoff i-factors for a particular nucleus at different concentrations; as a result, only sodium chloride has been studied extensively. In this report, a generalized expression for the solution effect on droplet growth is used, thus simplifying the study of the growth behaviors of a large number of promising condensation nuclei under equilibrium conditions. Tables are compiled to present their equilibrium growths and their physical properties, and a few graphs comparing these properties are included to illustrate how the data in these tables may be used. It is believed that the information presented herein will facilitate an intelligent selection of the proper artificial nuclei for the modification of warm fogs and clouds, when combined with adequate measurements of the pertinent environmental parameters. Author (TAB)

N69-40491# Army Electronics Command, Fort Monmouth, N.J
CONVERTER, RADIOSONDE DATA, CV-857(XE)/GMD
Frank W. Wilson Nov. 1968 55 p refs
(AD-691729; ECOM-3074) Avail: CFSTI CSCL 4/2

The Converter, Radiosonde Data, CV-857(XE-1) was designed and developed as a meteorological data-handling equipment which uses modern digital data techniques and unique conversion methods. The report presents a technical description of this equipment, with particular emphasis devoted to the digital circuit design principles and techniques incorporated for converting, processing, and recording meteorological data. Author (TAB)

N69-40521# Army Materiel Command, Hanover, N.H. Cold Regions Research and Engineering Lab.
FORMATION AND REDUCTION OF ICE FOG
Motoi Kumai Mar. 1969 29 p refs
(AD-691325; RR-235) Avail: CFSTI CSCL 4/2

During January and February of 1962, 1963 and 1964, Fairbanks, Alaska, and vicinity was the site of a series of studies dealing with ice fog and ice crystals. This report presents the results of an investigation of the amount and extent of air pollution and ice fog in the area with special emphasis on reducing ice fog by decreasing the water vapor being emitted into the atmosphere. The major sources of water vapor at the two military installations in the region, Fort Wainwright and Eielson AFB, are the heating and power plants and their associated cooling ponds. In the populated areas around Fairbanks, a high aerosol concentration of about 100,000 particles/cc exists, whereas in the uninhabited areas the concentration is extremely low (about 300 particles/cc). Much of the high concentration is due to the burning of coal for heat and power. Because the coal is of low grade it also emits about 350,000 kg of water vapor into the atmosphere on a day when the temperature is -40C. This water vapor condenses on the aerosols and produces ice fog. Anthracite or semi-bituminous coal would reduce the water vapor output to only 1/5 of the amount produced by the low grade coal. Water vapor from cooling ponds can be reduced by freezing the surfaces of the ponds. Author (TAB)

N69-40615# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 25: NASHVILLE, TENNESSEE METROPOLITAN AIRPORT Final Report
Jun. 1969 32 p ref
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-25) Avail: Issuing Activity

Tabulated data covering the period June 1969 are presented for the Nashville, Tennessee Metropolitan Airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N69-40710# Weather Bureau, Washington, D.C.
AUTOMATED PROCEDURES USED IN PREPARING OPERATIONAL AVIATION FORECASTS
J. E. Mc Donell *In* Brit. Air Line Pilots Assoc. Automation, Simulation and Data Handling in Civil Aviation 1968 p 115 – 126
(See N69-40702 24-02)
Avail: CFSTI

Automatic data processing techniques developed at the U.S. National Meteorological Center to produce enroute operational aviation forecasts for many altitudes are discussed. The relevant

steps taken in producing the forecasts, from the receipt of observations to the issuance of the messages and display charts, are treated in detail. The advantages of processing weather reports by high speed digital techniques, so as to speed up procedures and allow predictions by new and improved methods of numerical forecasting, are emphasized. A.C.R.

N69-40719# Centro Nazionale di Fisica dell Atmosfera e Meteorologia, Rome (Italy).
ICE-FORMING NUCLEI AND RELATED AEROSOL STUDIES
Jan Rosinski Consiglio Nazl. delle Ric. 1968 83 p refs Quaderni de la Ric. Sci. No. 46
(CENFAM-PV-31) Copyright. Avail: CFSTI

Research on ice-forming nuclei is reviewed and the role of terrestrial dust and particles of meteoritic origin is discussed along with the results of measurements carried out in the United States. The interaction of particles of different sizes is analyzed and the role of collector played by the larger of any two particles e.g. raindrop or hailstone in ice formation is stressed. ESRO

N69-40727# Naval Research Lab., Washington, D.C.
PLANNED OPERATIONS OF THE SOVIET HYDROMETEOROLOGICAL SERVICE IN THE AREA OF MARINE RESEARCH EXPEDITIONS [O PLANE RABOT GIDROMETEOROLOGICHESKOI SLUZHBY SOVETSKOGO SOYUZA V OBLASTI MORSKIKH EKSPEDITSIONNYKH ISSLEDOVANIY]
G. I. Matveitchuk 25 Jul. 1969 7 p Transl. into ENGLISH from Russian Conf. paper; presented at Oceanology Intern. 1969, Brighton, Engl., 17-21 Feb. 1969
(AD-691422; NRL-Trans-1176) Avail: CFSTI CSCL 4/2

The paper discusses plans of the USSR Hydrometeorological Service with respect to studying the world ocean. The purpose of marine research expeditions of the Hydrometeorological Service of the Soviet Union is to develop methods of meteorological and oceanological forecasting (especially long-range forecasting), and to obtain a fuller knowledge of the hydrometeorological conditions of the world ocean. TAB

N69-40734# Army Material Command, Hanover, N.H. Cold Regions Research and Engineering Lab.
MICROSPHERULES IN SNOW AND ICE-FOG CRYSTALS
Motoi Kumai Mar. 1969 16 p refs
(AD-691326; RR-245) Avail: CFSTI CSCL 8/12

Spherules found in snow crystals, ice-fog crystals, fallout particles, and fly ash were studied with an electron microscope using the electron diffraction method. The central part of the residues of 1004 specimens of natural snow crystals from Greenland, the United States, and Japan were examined; 14 sperules 0.1 to 1.5 micrometers in radius were found among them. The residues of 658 artificial ice-fog crystals formed from water vapor in flue gases of coal-burning electric power plants at Fairbanks, Alaska, were also examined; nine spherules were found. Spherules similar to those found in ice-fog residues were found in furnace-produced fly ash fallout at Fairbanks, Alaska. The electron microscope study indicated that less than 0.7% of the 1004 snow crystals contained spherules of possible extraterrestrial origin, and that snow crystals are formed mainly on clay mineral particles by heterogeneous nucleation. Author (TAB)

N69-40747# National Science Foundation, Washington, D.C.
WEATHER MODIFICATION Annual Report for the Fiscal Year Ending 30 Jun. 1968
Aug. 1968 144 p
(NSF-69-18; AR-10) Avail: SOD $0.65

Research and development progress in weather modification is summarized including precipitation modification, hail suppression, fog dissipation, cloud electricity, lightning, severe storms, and mathematical models. Social, economic, legal, and ecological aspects of weather modification are also discussed. J.A.M.

N69-40755 Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.
METEOROLOGICAL PROCEEDINGS. VOLUME 102, NUMBER 1: DAILY GROUND AND 850-MB MAPS OF THE NORTHERN HEMISPHERE FOR 1969, PART 1 Quarterly Report, 1 Jan. –31 Mar. 1969 [Meteorologische Abhandlungen. Band 102, Heft 1: Taegliche Boden- und 850-mb-Karten Der Nordhemisphaere in Jahre 1969, Teil 1 Vierteljahr, 1 Jan. –31 Mar. 1969]
Manfred Geb and Richard Scherhag 1969 185 p In GERMAN
(QR-1) Avail: CFSTI

The daily situations for the 850 mb level at 00 GMT and for ground level at 1200 GMT are shown on stereographic-projection charts, scale 1 : 75,000,000. K.W.

N69-40768# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Meteorologie.
THE PENETRATION OF TORNADO-LIKE VORTICES INTO THE BOUNDARY LAYER NUMERICAL EXPERIMENTS Final Scientific Report, 1 Feb. 1966 – 31 May 1969
A. Szillinsky and F. Wippermann 30 Jun. 1969 106 p refs
(Contract AF 61(052)-932)
(AD-691879; AFCRL-69-0321) Avail: CFSTI CSCL 4/2

A tornado-like vortex, which intensifies with time, is imposed on the upper boundary of the boundary layer. The downward development of this axisymmetric vortex is studied by numerical integration of the flow equations. The contour of the visible tornado funnel has been computed for various times. The streamlines, the fields of pressure deviation, and of the tangential velocity are presented for a time close to the steady state. The influence of a varying eddy diffusion coefficient is investigated. Author (TAB)

N69-40800# Environmental Data Service, Silver Spring, Md.
METEOROLOGICAL DROUGHT IN WEST VIRGINIA
Robert O. Weedfall Sep. 1969 21 p refs
(EDSTM-11) Avail: CFSTI

Palmer Drought Index values and precipitation data for the years 1931 through 1967 are tabulated for regional climatic divisions of West Virginia. Data are arranged chronologically and concurrently for climatic divisions to show differences in meteorological and climatic factors throughout the State. Palmer Drought Index values are examined in relation to major recognized droughts in northeastern United States and the State of West Virginia. Related studies – treating correlations of dependent and independent variables – are cited, and preliminary estimates are made of probable recurrence of extreme droughts and extended periods of drought. Author

N69-40814# Air Weather Service, Scott AFB, Ill.
THE AIR WEATHER SERVICE WEATHER-MODIFICATION PROGRAM FY 1969 Annual Survey Report
Herbert S. Appleman Jun. 1969 19 p
(AD-691811; AWS-TR-213; Rept-2) Avail: CFSTI CSCL 4/2

In the second year of its full-scale weather-modification program, the Air Weather Service carried out four supercooled-fog dissipation projects, two airborne and two ground-based. Airborne techniques using crushed dry ice and silver iodide fuses can now be considered fully operational, although testing will continue in order to optimize the equipment and techniques. The ground-based liquid-propane technique has reached a point to justify an operational test program using a network of fixed propane dispensers. The results of the ground-based warm-fog dissipation test, using sized sodium nitrate, indicated that this approach offers a possible solution to the problem. TAB

N69-40870# Weather Squadron (12th), Detachment 42, Topsham AFB, Maine.
THUNDERSTORM FORECASTING FOR THE NORTHEAST
Edward G. Bencks Jan. 1969 29 p refs
(AD-691819) Avail: CFSTI CSCL 4/2

In an attempt to aid the forecasters of Detachment 42, 12th Weather Squadron in the forecasting of thunderstorms, an evaluation was made of the Darkow Energy Index system using data of June, July, and August 1968. The results of this evaluation, as well as modifications proposed and their effectiveness, are presented. The goal of the method proposed is to give the forecaster an easily prepared tool which will be useful in determining where, when and how many thunderstorms will occur in the extreme northeastern United States and Canadian Maritimes. Author (TAB)

N69-40887 Michigan Univ., Ann Arbor.
THE SPRING LAKE ANTICYCLONE: ITS INFLUENCE ON THE ATMOSPHERIC AND WATER CIRCULATIONS
Alan Earl Strong (Ph.D. Thesis) 1968 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-2394

An air-water interaction study was performed near Waukegan, Illinois, to determine the effect of the cold waters of Lake Michigan on warm air flowing over them. The low level wind near the lake was always altered by the prevailing regional wind above the inversion. The major orthogonal gradient winds and their interaction with the lake anticyclone were compared with results from a numerical model of "sea effect." The most dramatic effect occurred when a warm offshore wind moved out over a developing inversion above the lake. Parallel-to-shore wind data from Waukegan demonstrated increased vertical motions from the balancing forces of the northerly gradient wind and the lake high over the reverse case of the southerly gradient wind and the lake high. Dissert. Abstr.

N69-41004 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 101, No. 3: RESULTS OF THE SYNOPTIC SERVICE DURING 1969. DAILY WEATHER MAPS (GROUND, 500 mb, 300 mb), AND SHORT SCIENTIFIC ARTICLES [METEOROLOGISCHE ABHANDLUNGEN. BAND 101, HEFT 3: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1969. TAEGLICHE WETTERKARTEN (BODEN, 4500 mb, 300 mb), UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE]
Richard Scherhag 1969 193 p refs In GERMAN
Avail: CFSTI

Separate maps are presented for the Northern Hemisphere, the North Atlantic - European area, Central Europe, Germany, and Berlin. The articles deal with a synoptic prediction technique, radar aerology, Arctic climatological fluctuations, benefits derived from meteorological services, and a dust storm over the southern U.S.S.R. Detailed winter sport situation reports for Germany are given for this period. Summaries for this period are also presented of the world's climatology and weather situation, predictions for Central Europe, and detailed meteorological data for Berlin. Transl. by K.W.

N69-41005 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 101, NO. 4: RESULTS OF THE SYNOPTIC SERVICE DURING 1969. DAILY WEATHER MAPS (GROUND, 500 mb, 300 mb), AND SHORT SCIENTIFIC ARTICLES [METEOROLOGISCHE ABHANDLUNGEN. BAND 101, HEFT 4: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1969. TAEGLICHE WETTERKARTEN (BODEN, 500 mb, 300 mb), UND KLEINERE WISSENSHAFTLICHE AUFSAETZE]
Richard Scherhag 1969 166 p refs In GERMAN
Avail: CFSTI

Separate maps are presented for the Northern Hemisphere, the North Atlantic - European area, Central Europe, Germany, and Berlin. The articles deal with some reflections on the meteorological service in Japan, silver iodide seeding of convective clouds, a comparison of station barometers with the Barolux device, rain in different climatic zones, an unusual barograph registration, and climatological anomalies in the equatorial Pacific. A summary is presented of the weather predicted for the summer of 1969, and detailed meteorological data for Berlin in April 1969 are given. Transl. by K.W.

N69-41007 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 94, NO. 4: DAILY WEATHER MAPS OF THE 100-mb AND 50-mb LEVELS, AND MAPS OF THE MONTHLY MEAN FOR 1968, PART 4, 4th QUARTER [METEOROLOGISCHE ABHANDLUNGEN. BAND 94, HEFT 4: TAEGLICHE HOEHENKARTEN DER 100-MB-FLAECHE UND DER 50 MB-FLAECHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1968, TEIL 4, 4th VIERTELJAHR]
Barbara Kriester, Karin Labitzke, Renate Lenschow, Wolfgang Roeder, Richard Scherhag et al. 1969 218 p In GERMAN
Avail: CFSTI

The synoptic situations for the Northern Hemisphere are shown. The monthly averages are also tabulated. In addition, monthly deviations and variations are indicated, and the circulation in the lower stratosphere during the entire period is discussed. Transl. by K.W.

N69-41008 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 106, NO. 1: DAILY WEATHER MAPS OF THE 100-mb AND 50-mb LEVELS, AND MAPS OF THE MONTHLY MEAN FOR 1969, PART 1, 1st QUARTER [METEOROLOGISCHE ABHANDLUNGEN. BAND 106, HEFT 1: TAEGLICHE HOEHENKARTEN DER 100-MB-FLAECHE UND DER 50 MB-FLAECHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1968, TEIL 1, 1st VIERTELJAHR]
Barbara Kriester, Karin Labitzke, Renate Lenschow, Wolfgang Roeder, Richard Scherhag et al. 1969 218 p In GERMAN
Avail: CFSTI

The type of data reported for this period is the same as described in abstract N69-41007. K.W.

N69-41013# France. Direction de al Meteorologie National, Paris.
CLIMATIC DATA OF THE DUMONT d'URVILLE STATION [DONNEES CLIMATIQUES DE LA STATION DUMONT D'URVILLE]
J. Chesneau and J. Heuzey May 1969 68 p In FRENCH *Its* Monograph No. 72
Avail: CFSTI

Climate tables are presented from the Dumont D'Urville station, and statistical data collected on the mean monthly averages of temperature, pressure and wind velocity from the Pointe Geological and Port-Martin stations. Surface measurements of mean monthly averages, daily averages, and extreme temperature values for snow fall, for ice, and visibility are shown. Included in the tables are statistical forms, averages, and graphical representations for wind, altitudes, and surface isobars. This information covers the periods 1956 to 1967 and April 1967 to February 1968. Transl. by E.H.W.

N69-41078# Pacific Northwest Forest and Range Experiment Station, Juneau, Alaska. Inst. of Northern Forestry.
POTENTIAL EVAPOTRANSPIRATION AND CLIMATE IN ALASKA BY THORNTHWAITE'S CLASSIFICATION
James H. Patric and Peter E. Black (State Univ. of N.Y., Syracuse. Coll. of Forestry) 1968 30 p refs
(PB-183786; PNW-71) Avail: CFSTI CSCL 04B

Estimates and measurements of potential evapotranspiration (PET) by Thornthwaite's methods showed good agreement with estimates and measurements by other methods. Natural vegetation is closely related to climate. Vegetation distribution in the interior seems governed more by temperature than by moisture availability. The available data heavily bias classifications of climate to sea-level and valley-bottom conditions. Author (USGRDR)

N69-41107# Weather Bureau, Sterling, Va. Test and Evaluation Lab.
THE AMOS 5 OBSERVER AID TEST, PART 2 Final Report
Elbert W. Atkins and Walter E. Hoehne Mar. 1969 72 p
(PB-183810; WBTM-T/EL-8-Pt-2) Avail: CFSTI CSCL 04B

The report discusses a test conducted to determine if the AMOS V and associated sensors could help an airport weather observer by automatically making weather observations, and by alerting the observer to significant changes in the weather. A separate section is devoted to each set of parameters. Each of these sections contains the following: (1) A comparison of methods by which the observers and the AMOS system obtain the values reported; (2) The results of a comparison of AMOS versus observer values; (3) A discussion of the problems encountered in the automation of weather observations. USGRDR

N69-41119# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES. VOLUME 28: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET Final Report
Jun. 1969 31 p refs
(Contract FA-67-WAI-129)
(SRDS-RD-69-22-Vol-28) Avail: CFSTI

This report consists of 41 volumes of climatological data for 41 different major airports. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Various weather and landing system categories are tabulated, in most cases from 10 years of data, as aids for making decisions affecting landing systems and fog dissipation at these 41 air terminals. Author

N69-41135# Weather Wing (1st), San Francisco, Calif. Detachment 4.
CLIMATOLOGY FOR ASIAN AND PACIFIC VISITS
Apr. 1969 138 p
(AD-686798; Rept-105-60) Avail: CFSTI CSCL 4/2

The document contains mean monthly or seasonal meteorological parameters for selected countries and was prepared primarily as a planning guide for staff visits. (TAB)

N69-41156# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET, VOLUME 30 Final Report
Jun. 1969 33 p
(Contract FA-67-WA1-129)
(SRDS-RD-69-22-Vol-30) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Metropolitan Oakland International Airport, Oakland, California. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N69-41227# Weather Bureau, Honolulu, Hawaii.
A COMPUTER METHOD TO GENERATE AND PLOT STREAMLINES
Roger A. Davis Feb. 1969 17 p refs
(PB-183622; WBTM-PR-5) Avail: CFSTI CSCL 04B

A description of a method of generating and plotting streamlines of Tropical Pacific wind fields is presented. The program, using objectively analyzed wind fields provided by the Hawaii Cooperative Tropical NWP Group, computes wind directions at .1 inch intervals along lines which are selectively spaced. These short line segments are connected and represent streamlines of instantaneous wind flow. Actual lines are traced by an incremental plotter. Cyclones and anticyclones in both hemispheres along with cols and other flow patterns showing confluence, diffluence, sources and sinks are well represented. Output is used to replace hand drawn streamlines, thus effecting a saving in manual effort. Author (USGRDR)

N69-41262# France. Direction de la Meteorologie Nationale, Paris.
CLIMATOLOGY OF THE BALE-MULHOUSE AIRPORT [CLIMATOLOGIE DE L'AERODROME DE BALE-MULHOUSE]
A. Tasson, R. Bubeck, J. Mouriaux, and P. Levdier Jun. 1969 57 p In FRENCH *Its* Monograph No. 70
Avail: CFSTI

Meteorological characteristics of the airport region are tabulated from 1947 to 1967. Generalizations on cloud patterns, visibility, gust and squall distribution, and wind pressure are made. Regional topography is briefly described. Tables record monthly temperature ranges, rainfall averages, wind profiles, and cloud distributions. An aerial map and meteorological diagrams accompany the tables. M.H.E.

N69-41264# State Planning Office of New Mex., Santa Fe. Resources Planning Div.
THE CLIMATE OF NEW MEXICO
Yi-Fu Tuan, Cyril E. Everard, and Jerold G. Widdison 1969 177 p refs Sponsored by Dept. of Housing and Urban Develop.
(PB-183823) Avail: CFSTI CSCL 04B

Contents: Climate: Some early observations; The scientific appreciation of climate; Precipitation Distribution; Rainfall intensity; Precipitation: Variability and trend; Temperature; Frost and the frost-free season; Sunshine; Dust and dust storms; Evaporation and evapotranspiration; A wet year: 1941; A dry year: 1956; Climate of New Mexico. USGRDR

N69-41275# Sandia Corp., Livermore, Calif.
LIGHTING ENVIRONMENTS
W. F. Gordon Apr. 1969 35 p refs
(Contract AT(129-1)-789)
(PB-183837; SCL-DR-69-40) Avail: CFSTI CSCL 04A

This report contains a basic description of lightning phenomena to assist system designers in (1) understanding the over-all environment, (2) identifying design strengths and weaknesses from a susceptibility standpoint, (3) viewing potential design problems in proper perspective, and (4) logically deriving an evaluation program with which to determine system transfer functions and ultimately susceptibility. The information is applicable to both safety and reliability design consideration. Lightning environments discussed include direct strikes to earth-based objects, direct strikes to airborne objects, and electromagnetic pulses from nearby strokes. Author (USGRDR)

N69-41276# Weather Bureau, Silver Spring, Md. Systems Plans and Design Div.
TRAFFIC ASPECTS OF MERCHANT SHIPS AS ENVIRONMENTAL OBSERVING PLATFORMS
Mar. 1969 31 p
(PB-183811; WBTM-SPDD-2) Avail: CFSTI CSCL 04B

In the Northern Hemisphere, the use of merchant ships as platforms for upper-air, surface, and oceanographic observations appears relatively attractive from a cost-performance point of view. USGRDR

N69-41308# Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
AN ATTEMPT TO DETERMINE SILVER CONTENT OF CLOUDS AND RAIN
H. Goete Oestlund and Robert D. Stearns Nov. 1969 9 p
(Grant E-22-99-68(G))
(ML-69166) Avail: Issuing Activity

A summary is presented for the samples of liquid water and ice collected by the EC-121 aircraft at 17,000 ft and by the

S-2D at about 2000 ft. Both unseeded and seeded clouds were sampled, and data were gathered both before and after seeding time. All samples were obtained by scoop and tube systems made entirely of polyvinyl chloride (PVC) and soft vinyl plastic, joined with PVC-cement or epoxy glue where necessary. The frozen samples were sent for silver analysis by neutron activation. A.C.R.

N69-41310 National Lending Library for Science and Technology, Boston Spa (England).
THE HORIZONTAL DISTRIBUTION OF TOTAL OZONE CONTENT IN THE NORTHERN HEMISPHERE
G. P. Guscin et al. 20 Jul. 1969 25 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 223, 1968 p 81-97
(NLL-M-7733-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Data from the period 1957 through 1965 was used to construct maps of the mean horizontal distribution of total atmospheric ozone content. A series of comparisons of data gathered by the U.S.S.R. ozone network and that from the world network is also included for the period 1961 through 1965. A.C.R.

N69-41359# Environmental Technical Applications Center (Air Force), Washington, D.C.
AN ANNOTATED CLIMATOLOGICAL BIBLIOGRAPHY OF INDIA
Dennis L. Boyer and Alvin L. Smith, Jr. Aug. 1969 62 p refs
(AD-691432; ETAC-TN-69-6) Avail: CFSTI CSCL 4/2

The bibliography contains 141 climatological references, with annotations, for India. Items are indexed by author (alphabetically) and by subject matter. All items listed were published subsequent to 1959. Author (TAB)

N69-41393 National Lending Library for Science and Technology, Boston Spa (England).
SOME PROBLEMS IN THE TECHNIQUE FOR OPTIMAL 3-DIMENSIONAL STATISTICAL INTERPOLATION OF THE GEOPOTENTIAL
M. S. Tatarskaja et al. 20 Jul. 1969 13 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Cent. SSSR, Gidromet. (Leningrad), no. 19, 1968 p 67-71
(NLL-M-7731-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A technique for obtaining an approximation to the three-dimensional function of geopotential which will ensure it will be definite positive definite is described. Some peculiarities of the objective analysis of the 50 mb contour field by means of optimal statistical interpolation are also described. Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N69-40055*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
A LIMB RADIANCE CALCULATION APPROACH FOR MODEL ATMOSPHERES CONTAINING HORIZONTAL GRADIENTS OF TEMPERATURE AND PRESSURE
Richard E. Davis Washington Oct. 1969 37 p refs
(NASA-TN-D-5495) Avail: CFSTI CSCL 17G

A method is developed, using a numerical limb radiance computational model for the 14- to 16-micron CO_2 band, that accounts for the fact that real atmospheres strictly never show the spherically symmetric temperature and pressure stratification that is normally assumed in the calculations of limb radiance. Equations incorporating the effects of horizontal gradients are given, and tests performed with a modified numerical radiance computational program are described. Some examples of the application of the method are given. An improvement in the computational accuracy is achieved by the new method. This result is significant under winter conditions when strong latitudinal temperature gradients exist in the middle and polar latitudes. Author

N69-40650# Coast Guard, Baltimore, Md. Field Testing and Development Center.
DEVELOPMENT OF A BATTERY-POWERED REMOTE CONTROL AND MONITER SYSTEM (RCMS)
W. E. Newland Washington 24 Jun. 1969 30 p
(AD-691413; Rept-494) Avail: CFSTI CSCL 17/7

A remote control and monitor system was developed for the controlling and monitoring of light and sound signals at a remotely situated aid to navigation. This report describes the system and contains a brief evaluation of the first seven months of its field usage. Author (TAB)

N69-40708# Hollandse Signaalapparaten N. V., Hengelo (Netherlands).
TACTICAL AIR TRAFFIC CONTROL
M. Staal *In* Brit. Air Line Pilots Assoc. Automation, Simulation and Data Handling in Civil Aviation 1968 p 86-96 (See N69-40702 24-02)
Avail: CFSTI

An integrated, civil-military air traffic control system which allows for radar and traffic control, as well as for ad hoc radar control, is treated. The control method is described as follows: Automation is used to achieve a close integration of traffic planning and radar control. Traffic handling is based on knowledge of the pilot's intent, on the route, speed, and flight level he wants to fly, and on adherence to air traffic control clearances. The aim is to further improve the use of radar for ATC, to improve upon the orderly flow of traffic, and to increase traffic handling capacity. The controllers in the system work together as a team, using the computer memory as one common source of information, rather than being individually responsible for part of the traffic and airspace. Possible future use of existing three-dimensional radar systems and high performance computers in air traffic control is also briefly treated. A.C.R.

N69-41014*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1969 NAVIGATION, GUIDANCE, AND CONTROL
John R. Scull 1969 17 p refs
(Contract NAS7-100)
(NASA-CR-106494) Avail: CFSTI CSCL 17G

A trajectory design section describes near-earth launch trajectory, planetary targeting, and constraints, as well as the tradeoffs made on the trajectory selection. Among the factors considered are reliability, direct ascent vs parking orbit, and higher spacecraft weight vs extended launch window. Guidance and orbit determination factors are discussed, including earth-based radio and spacecraft optical navigation and the accuracy of orbit determination and maneuver execution. The control systems section identifies differences in the attitude control, midcourse maneuver, and science instrument scan pointing systems from those used in previous Mariner spacecraft. A description is given of the new Central Computer and Sequencer (CC-S) system which allows extremely flexible spacecraft operation using in-flight reprogramming of the computer memory by radio command. Finally, reliability summaries and performance evaluations permit conclusions as to the effectiveness of the Mariner Mars 1969 navigation, guidance, and control systems to conduct near-term and more advanced planetary missions. Author

N69-41024# Lockheed Missiles and Space Co., Palo Alto, Calif.
GYROSTAT MOTION IN CIRCULAR ORBIT
A. P. Kharitonov [1969] 9 p refs Transl. into ENGLISH from Tr. Vses. S'ezda Teor. Prikl. Mekh., 2nd (Moscow), no. 4, 1969 p 42-48

Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Gyrostat motion relative to the center of mass in orbital flight is considered. Conditions are found for the stability of gyrostat stabilization by means of the radius-vector of the unperturbed circular orbit. Gravitational and aerodynamic moments act on a gyroscope in circular orbital motion and it is assumed that a certain perturbing moment whose projections on the axes are constants can act on the gyrostat. All the other external moments and the dry friction moment are assumed zero. Under the mentioned assumptions equilibrium positions are found for the gyrostat relative to the orbital coordinate system, and conditions for gyrostat stability in orbit are sought. Author

N69-41036*# Stanford Univ., Calif.
MINIMUM FUEL ATTITUDE CONTROL OF A NONLINEAR SATELLITE SYSTEM WITH BOUNDED CONTROL BY A METHOD BASED ON LINEAR PROGRAMMING
Gary D. Wolske and I. Fluegge-Lotz Washington NASA Oct. 1969 108 p refs
(Grant NGR-05-020-007)
(NASA-CR-1450; SUDAAR 374) Avail: CFSTI CSCL 17G

Fuel optimal controls are computed for the large angle attitude motions of a satellite system in which the control is obtained by three sets of gas jets with bounded thrusts, each generating torques about one of the principal axes of inertia. Using a result from optimal control theory, an algorithm is developed that iteratively improves on an initial guess (nominal) for the control history which does not meet terminal constraints and/or does not minimize the fuel cost. In using the algorithm, which is based on linear programming, it is necessary to express the variation of the fuel cost and variations of the components of the terminal state constraint vector as linear functions of variations in the control. The algorithm is tested on two sets of satellite differential equations. In one case, all dynamical effects are considered. In the other case, because control torque bounds are large enough, it is possible to neglect gravity gradient torque effects and orbital motion effects. A method to recursively approach minimum time control solutions by using this minimum fuel algorithm is described and illustrated. Author

N69-41134# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE CONSTRUCTION OF A GYROCOMPASS INERTIAL SYSTEM
V. P. Vasilenko et al. [1969] 3 p refs Transl. into ENGLISH from Tr. Vses. S'ezda Teor. Prikl. Mekh., 2nd (Moscow), no. 4, 1969 p 51-52
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The possibility of extracting information needed for continuous determination of the coordinates of a moving object, utilizing a gyroscopic compass as the sensor of an inertial navigation system, is considered. The errors in the investigated inertial system which might be due to inaccurate compliance with the initial conditions for the gyrocompass are also discussed. Formulas defining the errors in autonomous range determination (the distance between corresponding points of the nominal and actual trajectories along an arc of a great circle) are given. Author

N69-41221# Rome Univ. (Italy)
DRIFT COMPONENTS IN INERTIAL GYROSCOPIC SYSTEMS [COMPONENTI DI DRIFT IN SISTEMI GIROSCOPICI DI TIPO INERZIALE]
Gianfranco Manarini Feb. 1969 65 p In ITALIAN *Its* No. 20
Avail: CFSTI

The theoretical study relative to the drift components determination of a three axis gyro assembly for an inertial type guidance system is considered. The transient analysis of a practical method based on a static feedback signal is performed; the feedback signal applies its dynamic effect directly upon the output axis of each gyro. Author

N69-41241*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
ON OPTIMAL SCHEDULING AND HOLDING STRATEGIES FOR THE AIR TRAFFIC CONTROL PROBLEM
Lynn Willard Porter (M.S. Thesis) Sep. 1969 94 p refs
(Grant NGL-22-009-124; MIT Proj. 76265)
(NASA-CR-106400; ESL-R-401) Avail: CFSTI CSCL 17G

Problems of air traffic control in the guidance and scheduling of many aircraft converging to a terminal for landing are investigated. Emphasis is placed on the problems of maintaining adequate separation between aircraft to minimize collision risk and maintaining an acceptable airspeed in order to avoid unintentional stalls. A solution is effected by a linear, optimal, feedback controller that merges aircraft in several feeder guideways into a single string on final approach. Any deviation from the desired spacing or airspeed is quickly corrected by the linear controller. In the event such corrections would require unacceptable airspeeds, the proposed control algorithm directs the aircraft to perform a constant airspeed, time-optional maneuver outside the guideway. Simulation of the findings were performed on an analog computer. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N69-40020# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
DESIGN AND EVALUATION OF A LABORATORY NEUTRON GENERATOR
J. F. Howell, A. W. Pearson, and T. L. Wells 17 Apr. 1969 39 p refs
(Contract AT(29-2)-656)
(GEPP-63) Avail: CFSTI

Evaluated is a compact laboratory neutron generator, which is a highly stable, long-life source of 14-MeV neutrons. This generator produces single, 10-microsecond bursts of neutrons, which are continually variable from 2×10^6 to 2×10^7 total neutrons per pulse. Shot-to-shot variability of the total neutron output per pulse is less than ±5 percent of the mean. The neutron waveshape remains approximately constant over the range of output. Author (NSA)

N69-40024# Oak Ridge National Lab., Tenn.
MODIFICATIONS TO THE MONTE CARLO CODES USED TO CALCULATE POWER DISTRIBUTION AND NEUTRON LEAKAGE FROM THE TSF-SNAP REACTOR
K. D. Franz and V. R. Cain 12 Jun. 1969 135 p refs
(ORNL-TM-2562) Avail: CFSTI

Earlier calculations of power distribution and neutron leakage from the TSF-SNAP reactor assumed a small amount of Be uniformly distributed throughout the core and that the reactor control drums were fully inserted. These calculations were repeated with the distributed Be removed, a central cylinder of Be inserted and with two of the four control drums rotated out 30°. Listings are given of all the necessary changes in computer programs and their inputs. Author (NSA)

N69-40033# IIT Research Inst., Chicago, Ill.
RESEARCH ON ZIRCALOY BRAZE ALLOY DEVELOPMENT Final Report, 1 Apr. 1966 - 30 Jun. 1969
30 Jun. 1969 122 p
(Contract AT(11-1)-578)
(IITRI-578-P-29-37; EURAEC-2113) Avail: CFSTI

The development of braze alloys for use in a water-cooled reactor environment has been undertaken. A dynamic chemical

shim-resistant alloy for brazing Zircaloy-2 and Zircaloy-4 material was required. Over 150 candidate alloys were investigated for brazing capability and corrosion resistance. A number of braze alloys have been developed that are considered suitable for the application with moderate corrosion rates and good joint mechanical strength. These alloys are Zr – 50Ag, Zr – 29Mn, and Zr – 24Sn. Seven other alloys from the original selection proved to have good corrosion resistance but inferior mechanical properties. Author (NSA)

N69-40034# Idaho Nuclear Corp., Idaho Falls.
SEVERAL DETERIORATION MECHANISMS OF THE MATERIALS TESTING REACTOR BERYLLIUM
D. T. Neill and R. H. Morris May 1969 55 p refs
(Contract AT(10-1)-1230)
(IN-1289) Avail: CFSTI

Several possible mechanisms for the damage to the MTR beryllium reflector are examined. Detailed thermal and stress analyses are presented to support the selection of a combination of radiation growth and external restraint as the primary failure mechanism. Several suggestions are made to eliminate potential hazards to the replacement beryllium reflector. Author (NSA)

N69-40038# Reactor Centrum Nederland, Petten.
STOCHASTIC DETERMINATION OF NEUTRONIC COUPLINGS IN REACTORS BY CORRELATION AND PROBABILITY TECHNIQUES
Abdi Dalfes (Istanbul Tech. Univ.) and Erdinc Türkcan Aug. 1969 47 p refs Sponsored partly by Neth. Organ. for Sci. Res.
(Grant NATO-239)
(RCN-110) Avail: CFSTI

The equation relating the correlation matrix of counters located at suitable positions in a subcritical reactor is first set up following the theory of branching processes. Instead of solving the matrix equation, the correlation matrix of the counters is processed according to this equation in order to obtain the reactor matrix whose diagonal elements are related to the subcriticality of each region, and whose off-diagonal elements, to the coupling between them. Concurrently with the classical method, a probability method of computation is proposed for the processing of the data to determine the correlation matrix. Finally, experiments have been performed in the Argonaut-type Low Flux Reactor with two-slab and annular cores, by using two or three neutron counters. Results are processed digitally and interpreted according to the techniques outlined in the report. The elements of the reactor matrix, mentioned above, are found in most cases with a reasonable accuracy in a measuring time of a few minutes only. Author (ESRO)

N69-40060*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A STEAM CYCLE FOR AIRCRAFT NUCLEAR PROPULSION
Lawrence H. Fishback Washington Oct. 1969 21 p refs
(NASA-TM-X-1907) Avail: CFSTI CSCL 18E

A preliminary cycle analysis of a steam-driven, nuclear-powered turbofan engine is presented. It is found that maximum efficiency and minimum thrust per unit airflow both occur for a bypass ratio of zero. (This corresponds to minimum heat-exchanger-outlet air temperature.) Parametric numerical results are presented which can be used for selecting the proper engine operating conditions for a given airplane. Author

N69-40061*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERISTICS OF A 2.17-MEGAWATT FAST-SPECTRUM REACTOR CONCEPT USING AN AXIALLY MOVING REFLECTOR CONTROL SYSTEM
Wendell Mayo, Charles L. Whitmarsh, Jr., John V. Miller, and Hubert W. Allen Washington Oct. 1969 28 p refs
(NASA-TM-X-1911) Avail: CFSTI CSCL 18I

Neutronic, fluid flow, and heat-transfer calculations were performed for a reactor concept which makes extensive use of refractory metals for structure, cladding the uranium nitride fuel, and reflectors. Lithium-7 is the coolant. A design objective of operation for 50,000 hours at 2.17 MW is achieved by fuel zoning to shape the power and the temperature distributions in the core and equalize fuel cladding stresses. Calculations show that reactivity control requirements can be met with an axially moving reflector outside of the pressure vessel. Author

N69-40121# Battelle-Northwest, Richland, Wash.
NUCLEAR PARAMETERS AND PARAMETRIC STUDIES FOR THE FAST TEST REACTOR (FTR)
W. W. Little, Jr. and L. L. Maas Jun. 1969 48 p refs
(Contract AT(45-1)-1830)
(BNWL-1067) Avail: CFSTI

The principal neutronics characteristics of the vertical FTR reference reactor are described. Since the design has not been frozen, selected parametric studies are also included to show the effect of design changes. Author (NSA)

N69-40122# Oak Ridge National Lab., Tenn.
FRACTIONAL CRYSTALLIZATION REACTIONS IN THE SYSTEM LiF-BeF SUB 2-ThF SUB 4
R. E. Thoma and J. E. Ricci 8 Jul. 1969 33 p refs
(ORNL-TM-2596) Avail: CFSTI

Equilibrium and nonequilibrium crystallization reactions in the system $LiF-BeF_2-ThF_4$ were analyzed in relation to their potential application to molten salt reactor fuel reprocessing. Heterogeneous equilibria in the temperature range from the liquidus at 590°C to the solidus at 350°C are described quantitatively and in detail by means of ten typical isothermal sections and by three temperature-composition sections. The implications of metastable fractionation in this temperature interval are discussed as a possible feed control step in reductive extraction reprocessing of molten salt breeder reactor fuels. Author (NSA)

N69-40142# Oak Ridge National Lab., Tenn.
NUCLEAR REACTOR CORE ANALYSIS CODE: CITATION
T. B. Fowler and D. R. Vondy Jul. 1969 177 p
(Contract W-7405-eng-26)
(ORNL-TM-2496) Avail: CFSTI

A manual describing the use of the machine program CITATION is presented. Other sections are included which present auxiliary information, considerations in application and mathematical formulation. This code is intended to be a generalized computer code for analysis of nuclear reactor cores with treatment of one to three space dimensions. It has been organized to treat a wide variety of different types of calculations using an IBM-360/91 or an IBM-360/75 computer with bulk storage, or any equivalent computer with at least 3×10^5 directly-addressable words. Given such required data as broad-group microscopic neutron-nuclide reaction cross sections, depletion, dynamics, or static problems may be solved. The program is written in FORTRAN 4. Author (NSA)

N69-40145# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CREEP OF ZR-2.5 WT PERCENT NB ALLOY PRESSURE TUBES
P. J. Pankaskie Jun. 1969 17 p refs
(Contract AT(45-1)-1830)
(BNWL-1077) Avail: CFSTI

Creep and stress rupture data were obtained from prototypic reactor pressure tubing. Biaxial stress conditions, with a hoop to axial stress ratio of 2 to 1, were maintained by a constant internal pressure. Most of the testing was done at 400°C on tubing in the heat treated condition. Some tests were done at 300°C on tubing in the 30% and 60% cold work temper. The data obtained suggest that the heat-treated condition is sufficiently stable for use at 400°C. Author (NSA)

N69-40228# Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering.

FINITE DIFFERENCE TECHNIQUES FOR THE SOLUTION OF THE REACTOR KINETICS EQUATIONS
William H. Reed (Ph.D. Thesis) and K. F. Hansen. May 1969 88 p refs
(Contract AT(30-1)-3903)
(MIT-3903-2; MITNE-100) Avail: CFSTI

A class of finite difference methods called splitting techniques are presented for the solution of the multigroup diffusion theory reactor kinetics equations in two space dimensions. A subset of the above class is shown to be consistent with the differential equations and numerically stable. An exponential transformation of the semidiscrete equations is shown to reduce the truncation error of the above methods so that they become practical methods for two-dimensional problems. A variety of numerical experiments are presented which illustrate the truncation error, convergence rates, and stability of a particular member of the above class. 18 references. Author (NSA)

N69-40230# Bettis Atomic Power Lab., Pittsburgh, Pa.
THE IN-PILE THERMAL CONDUCTIVITY OF SELECTED THORIUM DIOXIDE AND URANIUM DIOXIDE FUELS AT LOW DEPLETIONS (LWBR DEVELOPMENT PROGRAM)
D. C. Jacobs. May 1969 70 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-758) Avail: CFSTI

The in-pile thermal conductivities of selected ThO_2–UO_2 fuel materials were determined by direct measurement using an in-pile extension of the radial heat-flow technique. The tests incorporated ThO_2 + 3.1 wt % UO_2, ThO_2 + 7.7 wt % UO_2, ThO_2 + 10 wt % UO_2, and UO_2 specimens. The microstructure, stoichiometry, density, impurity content, and unirradiated thermal conductivity were determined for each fuel material. The test results showed no statistically significant differences between the in-pile and unirradiated thermal conductivities for steady state operation for the UO_2 specimens at $600 \leq T \leq 1000^{\circ}C$, at a burnup of up to 5.6×10^{18} fission/cm^3 and for the ThO_2–UO_2 specimens at $400 \leq T \leq 1000^{\circ}C$ at a burnup of up to 1.4×10^{19} fission/cm^3. The in-pile conductivities were slightly, but significantly, greater than the unirradiated conductivities. Author (NSA)

N69-40349# Idaho Nuclear Corp., Idaho Falls.
URANIUM RECOVERY FROM ALUMINUM ALLOYED FUEL AT ICPP DURING FISCAL YEAR 1966
W. P. Palica and M. D. Gold. Jun. 1969 20 p refs
(Contract AT(10-1)-1230)
(IN-1153) Avail: CFSTI

Highly enriched uranium–aluminum alloyed fuels containing 426.6 kg of uranium were processed at the Idaho Chemical Processing Plant during fiscal year 1966 using a continuous nitric acid dissolution step followed by one tributyl phosphate and three Hexone extraction cycles. The uranium recovery was 99.74%, and the overall fission product decontamination was excellent. Gelatin was added (0.1 g/l) and the acidity of the first-extraction cycle feed was increased to 2.4M to reduce emulsions and minimize uranium losses. The feed tended to form stable emulsions because feed evaporation was not used. Solids also were troublesome in the first-extraction cycle. High waste volume, approximately double the rate achieved during the previous campaign, resulted due to the out-of-service first-cycle waste evaporator and to the short processing times. Approximately 300 grams of neptunium were recovered with high yields using chromic acid for valence shifting during this campaign instead of the ferrous sulfamate used previously. Author (NSA)

N69-40368# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
FUELS AND MATERIALS DEVELOPMENT PROGRAM
Quarterly Progress Report for Period Ending 31 Dec. 1968
P. Patriarca, comp. and D. J. Rucker, ed. May 1969 237 p refs
(Contract W-7405-eng-26)
(ORNL-4390) Avail: CFSTI

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1. FUELS AND CLADDINGS p 3–81 refs (See N69-40369 24-22)
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3. RADIATION DAMAGE TO STRUCTURAL MATERIALS p 113–156 refs (See N69-40371 24-22)
4. TECHNIQUES OF FABRICATION AND TESTING p 159–270 refs (See N69-40372 24-17)
5. ENGINEERING PROPERTIES OF REACTOR MATERIALS p 273–298 refs (See N69-40373 24-22)

N69-40369# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
FUELS AND CLADDINGS
In its Fuels and Mater. Develop. Program May 1969 p 3–81 refs (See N69-40368 24-22)
Avail: CFSTI

Uranium and plutonium oxide capsules for irradiation in the experimental breeder reactor-2 were prepared, and the facility for the fabrication of uranium, plutonium nitride pellets by hot or cold pressing and sintering was placed in operation. Zirconium metallurgy was investigated, and data on thermal diffusivity is presented. F.O.S.

N69-40370# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
COOLANTS
In its Fuels and Mater. Develop. Program May 1969 p 85–109 refs (See N69-40368 24-22)
Avail: CFSTI

The chemical and metallurgical effects produced in structural materials during exposure to alkali metals are investigated to guide the selection of container materials for sodium-cooled fast breeder reactor systems and lithium-cooled space power reactors. The mass transfer of interstitial impurities between vanadium alloys and sodium are studied with deoxidation of vanadium by molten lithium. A comprehensive study of the compatibility of stainless steel and insulation in the liquid metal fast breeder reactor is presented. F.O.S.

N69-40371# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
RADIATION DAMAGE TO STRUCTURAL MATERIALS
In its Fuels and Mater. Develop. Program May 1969 p 113–156 refs (See N69-40368 24-22)
Avail: CFSTI

The effects of high fast neutron fluences at temperatures from 150 to 1100°C on the properties of refractory nuclear materials for space and power reactors are evaluated with emphasis on nonfissionable ceramic materials such as the carbides, nitrides and silicides of refractory metals. High and low temperature irradiation damage to nonfissionable refractory materials are studied, and the experiments designed to determine the effects of irradiations on carbides and nitrides in depleted uranium are described. F.O.S.

N69-40373# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
ENGINEERING PROPERTIES OF REACTOR MATERIALS
In its Fuels and Mater. Develop. Program May 1969 p 273-298 refs (See N69-40368 24-22)
Avail: CFSTI

A broad, base-technology evaluation of high-temperature alloys for use in high-performance nuclear reactors and isotopic heat sources for advanced space, terrestrial, and civilian power applications is presented. Principle emphasis is placed on materials problems involving tantalum-, niobium-, molybdenum-, and

vanadium-base alloys for systems that use alkali metals as thermodynamic working fluids and heat-transfer media. Author

N69-40436# United Kindgom Atomic Energy Authority, Springfields (England). Reactor Group.

SIMPLE MODEL FOR ESTIMATING THE BOW OF FUEL ELEMENTS AFTER COMPLETE STRESS RELAXATION

R. G. Anderson. 20 Feb. 1969 22 p refs

(TRG-1836) Avail: CFSTI; HMSO: 3s

A model for estimating the bow of fuel elements after complete stress relaxation by creep is used to survey the range of possible final shapes of a simple structure. Some illustrations of fuel element bowing are given to illustrate the different concepts. It is found that the initial deflections can be substantially altered both in magnitude and direction. The methods developed are also applicable to a wide range of structural problems where additional deflections during stress relaxation are important. Author (NSA)

N69-40471# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.

STUDY OF THE THERMAL AND HYDRAULIC PHENOMENA OCCURRING DURING POWER EXCURSION ON A HEATED TEST SECTION [ETUDE DES PHENOMENES THERMIQUES ET HYDRAULIQUES ACCOMPAGNANT UNE EXCURSION RAPIDE DE PUISSANCE SUR UN CANAL CHAUFFANT]

Marcel Nyer (Ph.D. Thesis--Grenoble Univ., 28 Sep. 1967) Jun. 1969 157 p refs In FRENCH; ENGLISH summary

(CEA-R-3497) Avail: CFSTI

The thermal and hydrodynamic phenomena occurring during a power excursion were studied in an out-of-pile loop with a water cooled channel at low pressure (1 to 4 atm. abs.). Circular and rectangular test sections with electrically heated walls of two different thermal diffusivity materials (aluminum and stainless steel) were used. The rectangular test sections were 60 mm long, 35 mm wide and with a 2.9 mm gap and simulated two half plates of M. T. R. fuel element. Natural or forced convection was possible in the test section; the water height above it could be varied from 2.8 to 8 meters and the maximum allowed pressure at its outlet was 4 atm. abs. The heating source was a series of lead batteries which were able to generate, for short periods, 85 volts and 25 000 amperes. Linear, square or exponential power rise versus time could be realized. A 14 channel tape recorder (0--10 000 Hz bandwidth) was used to record measurement temperature, pressure and void fraction (X rays). More than 500 tests have been carried out. The influence of the initial water temperature, flow rate, pressure and water height on the water ejections, pressure variations and void fraction in the test section were studied. Tests with energies up to 3000 W/cm^2 in 50 ms were attemped and the energy above which the instabilities appear was determined. An interpretation of the observed phenomena and a simplified theoretical model are presented. Author (ESRO)

N69-40473# United Kingdom Atomic Energy Authority, Culcheth (England). Reactor Materials Lab.

EFFECTS OF NEUTRON IRRIADIATION ON THE CREEP-RUPTURE PROPERTIES OF TYPE 316 STAINLESS-STEEL TUBES

J. Standring, I. P. Bell, H. Tickle, and A. Glendinning. 14 Nov. 1968 17 p refs Presented at the ASTM 4th Intern. Symp. on the Effects of Radiation on Structural Mater., San Francisco, 26--28 Jun. 1968

(TRG-1789; Conf-680604-14) Avail: AEC Depository Libraries

The effects of irradiation in the Dounreay Fast Reactor and the Dounreay Materials Testing Reactor on the creep-rupture properties of Type 316 stainless steel tubing have been investigated. DFR irradiation produced a loss of rupture ductility but, in general, no change in creep strength in 650°C biaxial tests of solution-treated material. Cold-worked tubes suffered a loss of 550°C creep strength. Irradiation of solution-treated tubes at 650°C in DMTR caused a severe loss of high-temperature ductility and a ten-fold reduction of creep rate both during and after irradiation. It is possible that an irradiation-induced carbide precipitation process is responsible for the increase of creep strength. Author (NSA)

N69-40479# RAND Corp., Santa Monica, Calif.

EXACT SOLUTION TO THE RADIATIVE TRANSPORT EQUATION FOR THE GASEOUS-CORE REACTOR

A. Leonard (Stanford Univ.) and Eugene C. Gritton. Aug. 1969 6 p refs

(AD-691635; P-4148) Avail: CFSTI CSCL 18/11

The subject of radiation heat transfer in a gaseous medium has received attention recently due to the increased interest in gaseous-fueled cavity reactors. Initial studies utilized a diffusion theory approximation to the radiative transport equation. To ascertain the accuracy of these approximations, comparisons have been made with various numerical solutions of the exact radiative transport equation. However as the optical thickness of the gaseous media increases, the iterative solutions of the transport equation converge slowly. In this paper, we develop analytical solutions to the radiative transport equation which converge rapidly for all optical thicknesses. In particular, for the case of an optically thick medium, such as the gaseous-fuel in a cavity reactor, solutions are found in a closed form. The problem we consider is that of an absorbing, emitting and heat generating gray gas contained inside a black wall spherical cavity. Author (TAB)

N69-40553# Oak Ridge National Lab., Tenn. Chemical Technology Div.

UNIT OPERATIONS SECTION Quarterly Progress Report, July--Sep. 1967

M. E. Whatley, P. A. Haas, L. E. Mc Neese, L. E. Ryan, J. C. Suddath et al. Jul. 1969 96 p refs

(Contract W-7405-ENG-26)

(ORNL-4234) Avail: CFSTI

Research progress is reported under the following headings: stacked-clone contactor, engineering separation of biological macromolecular substances, sol-gel process development, thorium fuel-cycle studies, and molten-salt reactor processing studies. NSA

N69-40585# Central Research Inst. for Physics, Budapest (Hungary).

PULSED NEUTRON GENERATOR FOR REACTOR PHYSICS (NIG-200)

Z. Szabo and I. Dekany. 1969 26 p refs

(KFKI-5/1969) Avail: AEC Depository Libraries

A pulsed D-T neutron generator developed and built for measurements in multiplying media is described. The pulse target current is 5 mA, the neutron yield during the pulse $\approx 10^{11}$ n/s. The pulse length is variable from 10 μs to 1 ms, the repetition frequency from 0.1 to 2000 pps, the maximum duty cycle is 2%. The accelerating tube can be set to any position between the horizontal and vertical directions. The height of the rotational axis of the accelerating tube is variable from 0.90 m to 2.00 m above floor level. The 180 kV accelerating voltage is supplied by an insulating core transformer. Author (NSA)

N69-40593*# Techtran Corp., Glen Burnie, Md.

DEVELOPMENT OF EMITTERS AND COLLECTOR MULTILAYER SYSTEMS [ENTWICKLUNG VON EMITTERN UND KOLLEKTORMEHRSCHICHTSYSTEMEN]

H. Hubner et al. Washington NASA Oct. 1969 92 p refs Transl. into ENGLISH from German research report, Aug. 1968 118 p

(Contract NASw-1695)

(NASA-TT-F-12570; W-68-57) Avail: CFSTI CSCL 18I

The described work is a part of an in-core-thermionic reactor development program. The system is proposed as an energy source for space vehicles. The thermionic element is built up of eight cells in a series. UO_2 pellets will be used as fuel. The fission of gas of each emitter is vented separately to avoid swelling due to fission

gas pressure at the designed fuel burn up. Adequate methods to prevent plugging of the venting system were investigated. An instrumentive capsule for in-pile-testing emitters at nominal and higher heat rating was designed and is now under construction. Tungsten layers were deposited from the W $(CO)_6$. The interfacial diffusion of Mo – W was investigated. The joining technology for the design was developed. A method to build concentric collector systems (Nb – Al_2O_3 – Nb/1Zr) was proved with good success. Author

N69-40673# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Material-und Festkoerperforschung.
EXCHANGE REACTIONS OF URANIUM NITRIDE AND URANIUM DIOXIDE WITH POTENTIAL CLADDING MATERIALS OF FAST BREEDER REACTOR [WECHSELWIRKUNGEN VON MOEGLICHEN HUELLWERKSTOFFENDES SCHNELLEN BRUETERS MIT UN UND UO2]
O. Goetzmann and F. Thuemmler. *In* Plansee Soc. for Powder Met. 6th Plansee Seminar Preprints, Vol. 1 1968 45 p refs In GERMAN (See N69-40651 24-17)
Avail: CFSTI

Investigated was the cladding compatibility of vanadium, vanadium titanium, iron base, and nickel base alloys with uranium nuclear fuels. Uranium diffusion into vanadium titanium cladding alloys was already observed at 800° to 900°C; a higher titanium content even increased the diffusion. Uranium diffusion into the matrix of iron and nickel base alloys was minimal; however, an increase in nickel content lowered diffusion resistance. Overall, uranium dioxide proved compatible with the investigated cladding alloy materials, except with titanium-rich vanadium titanium alloys. Transl. by G.G.

N69-40720# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report, Apr. – May 1969
7 Jul. 1969 206 p refs
(Contract W-31-109-ENG-38)
(ANL-7577) Avail: CFSTI

Highlights of project activities are summarized for the report period. Fuels, physics, and components development for the LMFBR program are described. Fast reactor physics measurements with the ZPR-3 and ZPPR are reported. Modifications on ZPR-6 and ZPR-9 to permit operation with Pu loadings are nearly complete. Research and development programs using the EBR-2 are reviewed. General reactor technology development activities include fuels and materials studies and chemistry and chemical separations processes evaluations. Nuclear safety studies include TREAT operations, kinetics analysis, and energy release problems. NSA

N69-40721# Douglas United Nuclear, Inc., Richland, Wash.
FIRE-RESISTANT HYDRAULIC FLUIDS FOR REACTOR SAFETY SYSTEMS
28 May 1969 7 p Presented at the 15th Ann. Meeting of the Am. Nucl. Soc., Seattle, Wash. Prepared for AEC
(DUN-SA-117; CONF-690609-21) Avail:CFSTI

The fire resistant hydraulic fluids for the Hanford N Reactor control rod drive systems are discussed. Safety rod system operating conditions are described; requirements of the hydraulic fluid are detailed. Use of the water – oil invert emulsion is summarized; compatibility with rod drive systems components is discussed. Flammability and viscosity of the invert emulsion are described. NSA

N69-40739# Israel Atomic Energy Commission, Tel Aviv.
THE THEORY OF A ONE-DIMENSIONAL BARE REACTOR, TREATED BY THE LIE SERIES METHOD
M. Lemanska, Y. Ilamed, and S. Viftah Dec. 1968 13 p refs
(IA-1187) Avail: CFSTI

The one-dimensional G-group diffusion equation for the bare reactor is solved using the Lie series technique. A method for calculating the critical size of a bare reactor is given. It is shown by numerical analysis that this method of calculation is simpler than the usual diffusion method. Numerical examples are given. 13 references. Author (NSA)

N69-40749# Atomic Energy Commission, Washington, D.C. Advanced Converter Task Force.
AN EVALUATION OF ADVANCED CONVERTER REACTORS
Apr. 1969 157 p refs
(WASH-1087) Avail: SOD $1.50

The objectives and scope of study for an evaluation of advanced converter reactors are given. The concepts which are evaluated are described. Performance characteristics, economic evaluation, and fuel utilization characteristics are given for each of the concepts. The ground rules and cost basis for economic evaluation are defined. Technical evaluations of the concepts are detailed. Capital, fuel-cycle, operation and maintenance, and power costs are analyzed. The research and development programs for the heavy water-moderated organic-cooled reactor (HWOCR), the heavy water-moderated boiling light water-cooled reactor (HWBLW), and high temperature gas-cooled reactor (HTGR) concepts are discussed. NSA

N69-40753# Societe Belge pour l'Industrie Nucleaire, Brussels (Belgium).
PLUTONIUM RECYCLE IN THERMAL REACTORS. PRESENT STATUS OF THE BELGIAN PROGRAM
H. Bairiot and A. Lhost Apr. 1969 46 p refs Presented at the 15th Ann. Meeting of the Am. Nucl. Soc., Seattle, Wash.
(BN-6905-6; CONF-690609-6) Avail: AEC Depository Libraries

Work performed since 1960 in the Belgian Pu recycle program is summarized. Production and fabrication development on pellet type and vibratory compacted mixed oxide fuels is described. Experimental fuel irradiations are being conducted in the SENA and BR-3 reactors. The design of Pu recycle core configurations, the program of critical experiments, and the demonstration program in operating power reactors are discussed. NSA

N69-40817# Harvard Air Cleaning Lab., Cambridge, Mass.
REVIEW OF THE PROBABLE CHARACTERISTICS OF AEROSOLS RESULTING FROM ACCIDENTIAL LOSS OF SODIUM COOLANT
Parker C. Reist May 1969 50 p refs
(Contract AT(30-1)-841)
(NYO-841-18) Avail: CFSTI

The mechanisms by which aerosols are generated following an accident in a sodium cooled LMFBR and variations of aerosol characteristics with time and nature of the accident are examined. The results of the study are applied to a specific example accident case for the Fast Flux Test Facility. NSA

N69-40823# Scientific Translation Service, Ann Arbor, Mich.
PARAMETRIC STUDY OF THE NIOBE PROGRAM ON HARMONIE
B. Barre Nov. 1968 44 p refs Transl. into ENGLISH from French report no. CEA-N-1022 Sponsored by AEC Prepared for Oak Ridge Natl. Lab., Tenn.
(ORNL-tr-3026; CEA-N-1022) Avail: CFSTI

Capabilities of the NIOBE code for the solution to the neutron transport equation for spherical reactors are discussed. The discretization procedure that the code uses for solution to the Boltzmann Equation is described; the procedures used in the numerical solution are outlined. The various subroutines used in the NIOBE code are described. The Harmonie reactor, a low power fast reactor is described; the mathematical model of Harmonie, constructed for the NIOBE code, is detailed. Reactor parameters are identified with respect to their influence on computational time; convergence criteria are given. Results of NIOBE calculations of neutron spectra and fluxes are shown graphically. NSA

N69-40856# Oak Ridge National Lab., Tenn. General Engineering Div.

SURVEY AND ANALYSIS OF REMOTE TECHNOLOGY APPLICABLE TO DISASSEMBLY AND REASSEMBLY OF FFTE CORE COMPONENTS

R. M. Beckers Jul. 1969 45 p refs

(Contract W-7405-eng-26)

(ORNL-TM-2610) Avail: CFSTI

A survey was undertaken to obtain data for the conceptual design of special equipment to be used for remote disassembly and reassembly of driver fuel and test assemblies in the Fast Flux Test Facility. Some machines and techniques that embody principles which would contribute to the conceptual design of the special equipment are described and evaluated. Especial attention is given to the series of machines developed at Argonne National Laboratory for work on EBR-II core components. Information on the Vertical Assembler Dismantler is particularly useful because its operating features are very similar to those that will be required for disassembly and reassembly of Fast Test Reactor fuel and test assemblies. Selected features of this machine will therefore be used for the conceptual design of the disassembly-reassembly equipment for the Fast Flux Test Facility. 22 references. Author (NSA)

N69-40857# Argonne National Lab., Ill.

THE SUBROUTINE USED TO CALCULATE DESIGN BASIS ACCIDENTS FOR THE ZPR-6 AND -9 PLUTONIUM SAFETY ANALYSIS REPORT (ANL-7442)

G. K. Rusch and J. M. van Doorninck Dec. 1968 92 p refs

(Contract W-31-109-eng-38)

(ANL-7508) Avail: CFSTI

A one energy group, point-reactor kinetics code coupled to a one dimensional heat transfer subroutine, which is used by Argonne National Laboratory to calculate design basis accidents for ANL's fast critical facilities ZPR-6 and -9, is described. Heat transfer through the plate type material geometry used in ZPR-6 and-9 is determined, and the resultant Doppler and expansion feedback reactivity is calculated and factored into the kinetics code as the assumed excursion proceeds. The code is written for the IBM 360/50-75. A listing of the code and the input requirements are included. Author (NSA)

N69-40861# Oak Ridge National Lab., Tenn.

ANALYSES OF TRANSIENTS IN THE MSRE SYSTEM WITH U-233 FUEL

O. W. Burke and F. H. S. Clark Jun. 1969 47 p refs

(Contract W-7405-eng-26)

(ORNL-4397) Avail: CFSTI

The ^{233}U fueled MSRE system was simulated on the ORNL analog computer. The simulated system was used to evaluate the existing MSRE control and safety systems when used on the ^{233}U fueled system. The pertinent results and conclusions were as follows: (1) The safety system will limit the startup accident so that the peak power will be 100 kw. (2) A quantity of ^{233}U sufficient to cause a reactivity change of approximately $-1\%\ \delta K/K$ when precipitated out of the fuel at some point in the system external to the core could be swept back into the core in a concentrated form without causing excessive core damage. (3) The existing controller will control the ^{233}U fueled system in a stable manner; however, an increased velocity feedback gain will be required. Author (NSA)

N69-40909# General Electric Co., Sunnyvale, Calif. Advanced Products Operation.

SODIUM-COOLED REACTORS FAST CERAMIC REACTOR DEVELOPMENT PROGRAM Quarterly Report, May Jul. 1968

Aug. 1968 140 p refs

(Contract AT(04-3)-189)

(GEAP-5677; QR-27) Avail: CFSTI

Progress is reviewed for an analytical and experimental program to develop fast reactors using ceramic fuels, particularly plutonium and uranium dioxide. Tasks discussed are: defected fuel behavior; safety experimentation; fuel performance evaluation; integral fast flux irradiations; core neutronics, thermal-hydraulics, and safety analysis; and cladding development. E.C.

N69-40932# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.

SUBCOOLED-BLOWDOWN: LOFT-QUARTER-SCALE EXPERIMENTAL PRESSURES AND CALCULATED TRANSIENTS USING THE WHAM-CODE

George H. Hanson 18 Jun. 1969 24 p refs

(Contract AT(10-1)-205)

(CONF-690609-8) Avail: CFSTI

Experimental measurements of effects of subcooled blowdown on power reactor cooling systems are described; the results of these experiments are compared with the WHAM code to check its validity in calculating transients and blowdown effects. The use of WHAM-calculated blowdown pressures as forcing function input for structural dynamics codes is discussed. Author (NSA)

N69-40941# Oak Ridge National Lab., Tenn. Neutron Physics Div.

MEASUREMENT OF THE FAST-NEUTRON DOSE RATE TRANSMITTED THROUGH A LiH SHIELD WHEN USED AS A WINDOW IN IRON-OIL SHIELD MOCKUPS

F. J. Muckenthaler, J. L. Hull, J. J. Manning, G. M. Argo, C. C. Barringer et al. 20 Mar. 1969 43 p refs Sponsored by AEC

(ORNL-TM-2542) Avail: CFSTI

Measurements were made of the fast-neutron dose rates transmitted through a LiH SNAP shield surrounded by various collar shield mockups of iron and oil. The source used was a collimated beam of neutrons from the TSR-II reactor. Data were obtained at a constant distance behind the LiH shield for combinations of several angles of neutron incidence, iron-oil configurations, and different locations of neutron incidence with respect to the shield axis. Author (NSA)

N69-40973# Oak Ridge National Lab., Tenn.

THEORETICAL DYNAMIC ANALYSIS OF THE NSRE WITH U-233 FUEL

R. C. Steffy, Jr. and P. J. Wood Jul. 1969 43 p refs

(Contract W-7405-eng-26)

(ORNL-TM-2571) Avail: CFSTI

A study undertaken to characterize the dynamics of the ^{233}U-fueled MSRE prior to operation revealed that the system is inherently asymptotically stable at all power levels above zero. The motivation for these studies was the expected difference between the MSRE dynamic response with ^{233}U fuel and with ^{235}U fuel because of the smaller delayed-neutron fraction of ^{233}U. An existing system model, previously verified for ^{235}U fuel, was modified for use in this work. The reactor system response to reactivity perturbations is rapid and nonoscillatory at high power, and it becomes sluggish and oscillatory at lower powers. These characteristics were determined by three methods: transient-response analyses, including a check of the validity of the linear model; a frequency response and sensitivity study; and stability analyses, both by inspection of the system eigen-values and by application of the recently developed, modified Mikhailov criterion. Author (NSA)

N69-41001# Bettis Atomic Power Lab., Pittsburgh, Pa.

EVALUATION OF REACTOR STEADY STATE THERMAL AND HYDRAULIC TEST PERFORMANCE FOR THE FIRST HALF OF PWR CORE 2, SEED 1 LIFE

D. L. Crum, Jr. Oct. 1968 168 p refs

(Contract AT(11-1)-GEN-14)

(WAPD-PWR-TE-209) Avail: CFSTI

Results and evaluation of the data obtained from the thermal and hydraulic testing performed on the second core installed at the Shippingport Atomic Power Station from the beginning-of-life to the approximate mid-life of the first seed are presented. The data are compared with both best estimate and design calculations to

provide a basis for evaluation of both the core thermal performance and the adequacy of the thermal and hydraulic design procedures. It is concluded that the thermal margin of safety of the core exceeded that indicated by the thermal design analyses at all times, and that the hydraulic analysis design procedures and the applicable portions of the nuclear and thermal analysis procedures are generally satisfactory with certain exceptions noted. The core instrumentation was observed to perform satisfactorily and the importance of frequent or timely instrument calibrations was indicated. Author (TAB)

N69-41028# Babcock and Wilcox Co., Lynchburg, Va. Critical Experiment Lab.
PHYSICS VERIFICATION PROGRAM, PART 3 Quarterly Technical Report, Oct. - Dec. 1968
M. N. Baldwin and M. E. Stern. May 1969. 33 p. refs.
(Contract AT(30-1)-3647)
(BAW-3647-11-Pt-3) Avail: CFSTI

The measurement of power perturbations produced in the area of strongly absorbing pins which simulate control rods is discussed. The critical assembly, on which these measurements were made, is described; design parameters are detailed. Power densities relative to core position are tabulated for north, south, east, and west traverses. Author (NSA)

N69-41048# United Kingdom Atomic Energy Authority, Harwell (England).
MULTIPLEXED REMOTE CONTROL AND INDICATION FOR BEAM TRANSPORT POWER SUPPLIES
P. Schneckenburger. Sep. 1968. 18 p. Transl. into ENGLISH from CERN Report MPS/PO/NOTE-68-2, Geneva, 1968
(NP-TR-1802) Avail: AEC Depository Libraries

The multiplex system is described for transmission of control signals and indications in connection with beam transport power supplies. The installation consists of the rack ERB 3 or other housing for the rectifiers and the control facilities, including the control room and the beam users. Author (NSA)

N69-41049# Plessey Co., Ltd., Ilford (England).
REACTOR INSTRUMENTATION
A. J. Trott. [1968] 17 p. refs. Presented at the BNX/BNF Nucl. Power Meeting, Copenhagen
(CONF-680625-3) Avail: AEC Depository Libraries

Instrumentation requirements for neutron flux measurements and failed fuel element detection for reactors are discussed. Required ranges for operation of instrumentation are defined; basic methods of flux density measurements are described. Components and designs for failed fuel element detection are considered. Cross sections of boron lined proportional counters, compensated and uncompensated ion chambers, and in-core flux monitoring channel assemblies are included. A schematic of an in-core instrumentation system is given which includes flux mapping instrumentation. Author (NSA)

N69-41111# Brookhaven National Lab., Upton, N.Y. Dept. of Applied Science.
APPLICATIONS OF CHEMICAL REACTOR DESIGN PRINCIPLES TO DOSIMETRY IN FLOW SYSTEMS
F. B. Hill, P. T. Fallon, A. C. Muller, and M. A. Rothbart. [1969] 32 p. refs. Presented at Symp. on Util. of large Radiation Sources and Accelerators in Ind. Process., Munich. Sponsored by AEC
(BNL-13766, Conf-690805-1, SM-123/44) Avail: CFSTI

Problems arising in chemical dosimetry in flow systems were analyzed in terms of chemical reactor design principles and were studied experimentally. Calculations were made of fraction conversion-dose relations in radiation chemical reactors with nonuniform distributions of dose rate and residence time in which the reactant was the aerated Fricke dosimeter solution. Reactors considered had annular reaction volumes with axial line sources and included the continuous tubular reactor and the continuous stirred tank reactor. The calculations showed that at large conversions the rate of radial mixing in the single-pass tubular reactor and degree of segregation in the stirred tank reactor are important factors relating conversion to absorbed dose. Initial rates, however, are unaffected by mixing or degree of segregation, and, therefore, can in principle be used to determine absorbed dose. The determination may also be made from data from the tubular reactor when operated with almost total recycle. Author (NSA)

N69-41180# Alternate Coolant Task Force.
EVALUATION OF ALTERNATE COOLANT FAST BREEDER REACTORS
Apr. 1969. 180 p. refs. Sponsored by AEC
(WASH-1090) Avail: GPO $1.75

The specific fast breeder reactor concepts using coolants other than Na are assessed in detail. Four reactor designs are considered: three cooled by steam at 1250, 2650, and 3700 psi, and the fourth cooled by He. The relative value of the concepts are evaluated from the standpoint of technical feasibility, economic potential, and fuel utilization performance. Both concepts were concluded to be technically feasible, to be capable of breeding ratios of interest, and to present no major safety problems. NSA

N69-41204# Nuclear Materials and Equipment Corp., Apollo, Pa.
DEVELOPMENT AND TESTING OF PLUTONIUM DIOXIDE URANIUM OXIDE FAST REACTOR FUELS Quarterly Report, Apr. - Jun. 1968
Aug. 1968. 41 p. refs.
(Contract AT(30-1)-3524)
(NUMEC-3524-55; QR-13) Avail: CFSTI

Plutonium and uranium oxides were developed for fast reactor use. The fuels were tested for impurities and its effects. Descriptions are given on the oxalate process, and air oxidation of metal. Included are hammermilling, ballmilling, and plutonium oxide ratios in several other metals. E.H.W.

N69-41205# Minnesota Mining and Mfg. Co., St. Paul, Minn. Electrical Products Group.
DEEP SEA RADIOISOTOPE-FUELED THERMOELECTRIC GENERATOR POWER SUPPLY SYSTEM, SNAP-21 PROGRAM, PHASE 2 Quarterly Report, 1 Jan. - 31 Mar. 1969
31 Mar. 1969. 156 p.
(Contract AT(30-1)-3691)
(MMM-3691-47; QR-11) Avail: CFSTI

Thermal insulation, thermoelectric cells, vacuum, and shielding systems were fabricated and tested for use in SNAP 21. Both material and performance tests were conducted for the nuclear power systems. Thermophile performance is also included. Hastelloy X was used to develop the systems. E.H.W.

N69-41235# Gulf General Atomic, San Diego, Calif.
FAST REACTOR SPECTRUM MEASUREMENTS Quarterly Progress Report, Period Ending 30 Apr. 1969
J. C. Young, P. D'Oultremont, R. J. Cerbone, and J. M. Neill. 15 May 1969. 36 p. refs.
(Contract AT(04-3)-167)
(GA-9386) Avail: CFSTI

Core loading, atom densities, fuel geometries, and the experimental program for the critical assemblies of the STSF-2 reactor are described. The GAM and GAFGAR codes are used to calculate and compare neutron fluxes and spectra in the STSF-2 and STSF-3 reactors. Techniques for neutron cross section generation for fast reactors are compared. Two-dimensional analysis is applied to calculate neutron time-of-flight spectra in fast reactors. NSA

N69-41245# United Kingdom Atomic Energy Authority, Harwell (England).
DIFFERENTIAL THERMOCOUPLE AND ITS ERRORS IN A REACTOR ENVIRONMENT
A. Smith. Apr. 1969. 11 p. refs.

(AERE-R 5921) Avail: CFSTI; UK 2s 6d

A differential thermocouple is described and its errors compared with those of a backed-off pair of thermocouples in a reactor environment, using experimental data on the change of Seebeck coefficient with temperature and time. Data on changes of Seebeck coefficient with integrated flux enabled an estimate of the performance of a differential thermocouple constructed of three materials to be made. An experimental program to obtain further data for the more accurate prediction of its performance is outlined. Author (NSA)

N69-41252# Institutt for Atomenergi, Kjeller (Norway).

MEASUREMENT OF INTRACELL FISSION DENSITY AND FAST NEUTRON FLUX DISTRIBUTIONS IN THE NORA REACTOR WITH SOLID STATE NUCLEAR TRACK DETECTORS

J. W. N. Tuyn Mar. 1969 49 p refs Sponsored in part by AEC Prepared in cooperation with Reactor Centrum Nederland, Petten

(KR-134) Avail: AEC Depository Libraries

Solid state nuclear track detectors of silver-activated phosphate glass and polycarbonate plastic have provided intracell fission density and fast neutron flux distributions in the NORA reactor. The fission density distributions were measured in a clean lattice and within fuel elements in the vicinity of grey absorber control elements. The measured intracell fast neutron flux distributions were used for the evaluation of the so-called fast advantage factors (fuel-to-moderator neutron flux ratios at fission energies). Integral measurements of the fast advantage factors were performed by foil activation. As far as the experimental results presented could be compared with theoretical calculations, a good agreement was found. The use of a microdensitometer to determine the track density distributions on the surface of irradiated detectors has proved to be very convenient. A simple model for the development of tracks in solid state nuclear track detectors was constructed. Author (NSA)

N69-41257# Battelle Memorial Inst., Columbus, Ohio.

THE DEVELOPMENT OF BERYLLIUM OXIDE THORIUM DIOXIDE PLUTONIUM DIOXIDE FUELS

M. S. Farkas, D.Cheney, C. M. Brockway, and V. W. Storhok 27 Sep. 1968 28 p refs

(Contract W-7405-eng-92)

(BMI-X-10242) Avail: CFSTI

Studies indicated that the solid solubilities of ThO_2, PuO_2, and $(Th_{0.5}Pu_{0.5})O_2$ in BeO are less than 0.05 mole % at temperatures below 1700°C. The minimum solidus temperature in the $BeO-ThO_2-PuO_2$ system is 2150°C and occurs at the $BeO-PuO_2$ eutectic. $(Th,Pu)O_2$ solid solutions were chemically stable in wet helium, CO_2, and air atmospheres at 1600°C. In hydrogen, however, the solid solution decomposed to $(Th,Pu)O_{2-x}$ and Pu_2O_3. A particle decrepitation that occurred in all atmospheres was attributed to strains produced by gas pressures generated by the thermal decomposition of hydrocarbons entrapped in the particles during the Sol-Gel preparation process. Techniques for fabricating fuel oxide dispersions in high-density, fine-grained BeO matrices were developed. Voids around the individual fuel particles to accommodate swelling were incorporated through use of a burnout layer. Author (NSA)

N69-41294# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

CRITICALITY PROBLEMS IN THE ESSOR PLANT [PROBLEMI DI CRITICITA NEL COMPLESSO ESSOR]

S. Ragusa and R. Ricchena Jul. 1969 51 p refs In ITALIAN; ENGLISH summary

(EUR-4285-I) Avail: CFSTI

Some of the installations annexed to the ESSOR reactor and part of the plant are designed to receive fuel elements: an inspection and disassembly laboratory, a storage room for new elements, and a decay pool for irradiated fuel elements. The three different fuel elements used in the reactor were examined: sintered uranium and aluminum enriched at 95%, UO_2 enriched at 1.8%, and UC enriched at 1.8%. For each element, criticality calculations were performed for two different lattices and for foreseeable operating and accident conditions (storage, loading and unloading, disassembling, flooding, melting). The verification was made by comparison with standard critical configurations literature or by calculation of the multiplication constant. The DTF_4 code and the Hansen and Roach cross sections library were used to take into account the resonance absorption of U 238. As far as possible, the configurations were verified with both procedures. Safety rules were established as a result of these calculations. Author

N69-41363# Argonne National Lab., Ill.

DEVELOPMENT OF BRAZING TECHNIQUES AND PROCEDURES FOR FABRICATING FUEL SUBASSEMBLIES FOR THE ARGONNE ADVANCED RESEARCH RESEARCH REACTOR (AARR)

W. M. Kolba, C. V. Pearson, and W. C. Kramer Aug. 1968 113 p refs

(Contract W-31-109-eng-38)

(ANL-7458) Avail: CFSTI

The design of the AARR included rhomboidal fuel subassemblies of Type 347 stainless steel-clad fuel plates. A standard subassembly contained 27 plates of highly enriched spheroidal UO_2 uniformly dispersed in a Type 347 stainless steel matrix. The fuel plates were to be spaced and supported by square wires welded or brazed vertically at intervals along the edges and continuously along the axial centerline. Rhomboidal Type 347 stainless steel end fittings were to be welded to plate extensions at the top and bottom. Brazing was selected as the method of fuel plate assembly, and the program implemented to develop optimized brazing process-product specifications for use in vendor-qualification tests and ultimate AARR fuel subassembly commercial fabrication is described. Brazing development activities and test fabrication of full-scale dummy fuel-plate assemblies are presented, and the reference fabrication procedure is outlined. NSA

N69-41365# Babcock and Wilcox Co., Lynchburg, Va. Research and Development Div.

GEL ADDITIONAL PROCESS CHEMICAL STUDIES Quarterly Progress Report, Feb. - Apr. 1969

R. V. Carlson, comp. Jun. 1969 22 p refs

(Contracts AT(30-1)-3714; 859-3100)

(BAW-3714-13; QPR-11) Avail: CFSTI

Development of a sol-gel process is reported in which the preparation of $UO_2-20\%$ PuO_2 sol-gel spherical fuel in two size ranges for thermal reactor testing was completed. Two uranium enrichments, depleted UO_2 and 20% enriched $^{235}UO_2$, were used to prepare materials that will yield two different heat rates with fuel of the same U/Pu ratio. Also completed are the six initial capsule irradiation tests in a series that will show the differences in the restructuring kinetics of pellets and vibratory compacted spheres and shards. The heat rate varied from about 5 to 20 kW/ft, and the exposure time varied from about 1 to 9 EFPD. All the capsules are cooling pending hot cell examination. The seventh capsule in the series has been fabricated. The evaluation of procedures for the determination of moisture content and oxygen stoichiometry in mixed oxide fuels is complete. The average relative standard deviation from a series of oxygen-to-metal analyses was found to be 0.176%. Author (NSA)

N69-41366# Battelle Memorial Inst., Columbus, Ohio.

PROGRESS ON HIGH-TEMPERATURE FUELS TECHNOLOGY Quarterly Report, Feb. - Apr. 1969

Donald L. Keller and Walston Chubb May 1969 96 p ref

(Contract W-7405-eng-92)

(BMI-1864) Avail: CFSTI

A pronounced columnar grain structure accompanied by lenticular voids has been observed in UN specimens irradiated at

surface temperatures over 1750°C. Data on the steady-state evaporation rates of refractory fuels show that at 2000°K the evaporation rates of UC are much lower than those of UO_2 and UN. These data provide a physical basis for the proposed mechanism of zone purification of UO_2 and UN by lenticular void movement during irradiations. A tentative evaluation of the gas pressures monitored inside the cladding of a UO_2 specimen being irradiated at a surface temperature of 1890°C suggests that the gas generated in this specimen is released essentially instantaneously. The preliminary results of a fission-gas-bubble re-solution experiment suggest that an exposure of about 2×10^{15} fissions per cm^3 is sufficient to redissolve all the fission-gas-bubble nuclei produced by an initial exposure to 1.5×10^{16} fissions per cm^3 followed by an anneal of 24 hr at 1600°C to form bubble nuclei. Author (NSA)

N69-41374# North American Rockwell Corp., Canoga Park, Calif.
LMFBR PHYSICS PROGRAMS Quarterly Technical Progress Report, Jan. - Mar. 1969
31 May 1969 44 p
(Contract AT(04-3)-701)
(AI-AEC-12815) Avail: CFSTI

Progress on four reactor physics tasks is reported. Task 1 is an investigation into reactivity, temperature, and Doppler coefficients of materials in fast reactor spectra, and the effects of geometric arrangements of these materials, including the variation of surface-to-mass ratio. Task 2 advances the state-of-the-art of Monte Carlo applications to the analysis of fast reactors and fast critical assemblies. Task 3 in cross section analysis for reactor physics technology includes (1) the evaluation, production, and maintenance of current basic nuclear data; (2) production and evaluation of multigroup constants; and (3) the improvement of neutronic calculation methods as related to microscopic and macroscopic nuclear data. Task 4 is to supply data on the safe and economic design and operation of fast power reactors. M.H.E.

N69-41376# Gulf General Atomic, San Diego, Calif.
HTGR BASE PROGRAM Quarterly Progress Report, Period Ending 30 Nov. 1967
29 Dec. 1967 146 p
(Contract AT(04-3)-167)
(GA-8356) Avail: CFSTI

Results of continuing research involving HTGR systems are presented. Topics include: isotopic diffusion in fuel particle coatings; radiation effects on crystal structure of various reactor materials; stress and fission product analysis; design parameters for 1000 MW(e) gas-cooled reactor, including a cost analysis of the HTGR concept; high temperature reactivity characteristics; and gamma radiation buildup factors and effects of source energy on graphite properties. A.C.R.

N69-41400# Los Alamos Scientific Lab., N.Mex.
DIFFERENTIAL THERMAL ANALYSIS APPARATUS FOR OBSERVATION OF REFRACTORY PLUTONIUM COMPOUNDS
J. G. Reavis, J. F. Buchen, and J. A. Leary 20 Jan. 1969 6 p refs
(Contract W-7405-eng-36)
(LA-4103) Avail: CFSTI

An apparatus was constructed and used to measure melting points and temperatures of crystallographic transition of refractory compounds of Pu and other intense alpha emitters potentially useful as reactor fuels. The thermal analysis apparatus responds to light energy radiated by the sample and furnace, and temperatures are measured by optical pyrometry. The specialized nature of the equipment necessitated an intensive calibration study over the range 1000° to 2440°C. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N69-40148# National Physical Lab., Teddington (England). Aerodynamics Div.
ACOUSTICAL CHARACTERISTICS OF FIBROUS ABSORBENT MATERIALS
M. E. Delany and E. N. Bazley Mar. 1969 27 p refs
(NPL-AERO-Ac-37) Copyright. Avail: CFSTI

An extensive investigation into the acoustical properties of fibrous absorbent materials has been carried out. Measured values of characteristic impedance and propagation coefficient are each normalized in terms of power-law functions of frequency divided by flow-resistance. The resulting empirical relations are interpreted in terms of parameters characterizing the material and are each compared with theoretical predictions for an idealized material. For most practical applications a knowledge of the flow resistance allows use of the normalized data and eliminates the need for routine impedance-tube measurements. Author (ESRO)

N69-40171 Missouri Univ., Columbia.
THE PENETRATION OF PULSED ELECTROMAGNETIC FIELDS INTO A CONDUCTOR
Chan Shu-Bing (Ph.D. Thesis) 1968 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-3368

In the nondestructive testing of metals using pulsed eddy currents much higher resolution is achieved by the use of masked probes. It is necessary to have more knowledge about the electromagnetic fields and current densities in the metal being tested under such probes so that, for example, the depth of penetration in the metal may be determined. An experiment showed that the field immediately under the aperture of the masked probe could be either symmetrical or unsymmetrical in form. It was found, however, that much stronger fields were obtained when the field was unsymmetrical, so this case will be treated and discussed in more detail. Four different cases will be studied. The symmetrical and unsymmetrical fields are applied to the surface of a semi-infinite conductor for the first two cases, and above its surface for the last two cases. The current density is shown as a function of the radial distance measured parallel to the surface of the conductor from the point at which the maximum value of the field is applied. Dissert. Abstr.

N69-40213 National Lending Library for Science and Technology, Boston Spa (England).
LIGHT SCATTERING AND GLASS STRUCTURE
L. Prod'homme 21 May 1969 18 p refs Transl. into ENGLISH from Rev. d'Optique (Paris), v. 45, pt. 4, 1966 p 163 - 176
(NLL-PORS-Trans-2555-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

After reviewing light scattering phenomena in classical cases, where the scatterers are particles showing a univocal change in refractive index, the case of particles exhibiting complicated interfacial refraction changes were examined in the Rayleigh - Gans approximation. Scatterers of this type appear in glasses where a phase separation is present. It is now possible to follow the various stages of this separation by investigating either the spectral composition or the angular distribution of light scattered by these media. It is especially shown how the scattering envelope, which is a perfect circle in the case of homogeneous glasses, gradually grows longer backward and next exhibits a maximum at large scattering angles in the case of phase separated glasses. As the separation goes on, this maximum moves to smaller scattering angles and eventually the envelope grows longer forward. Author

N69-40235# National Physical Lab., Teddington (England). Aerodynamics Div.

A NOTE ON THE EFFECT OF GROUND ABSORPTION IN THE MEASUREMENT OF AIRCRAFT NOISE

M. E. Delany and E. N. Bazley Jun. 1969 17 p refs

(NPL-AERO-Ac-41) Copyright. Avail: CFSTI

It is shown that results of available theoretical analyses of the farfield sound pressure due to a simple source above an absorbing plane are capable of simple interpretation, and that certain published experimental values of excess attenuation obtained from measurements near the ground are consistent with such results. The effects of changing various parameters are demonstrated and estimates made of the errors likely to be incurred if effects of ground absorption are ignored when determining normalized values of the noise of aircraft. Author (ESRO)

N69-40296*# Rochester Univ., N.Y. Inst. of Optics.

PROPERTIES OF MULTILAYER FILTERS Interim Report, 1 Mar. – 31 Aug. 1969

P. W. Baumeister 31 Aug. 1969 60 p refs

(Grant NGL-33-019-003)

(NASA-CR-106335) Avail: CFSTI CSCL 20E

Various parameters influencing the effect of blocking filters on the long-wavelength rejection of an ultraviolet bandpass filter are studied. The parameters include: (1) the number of blocking filters used; (2) the number of layers in the individual blocking filters; (3) the physical arrangement of the blocking filters with respect to the bandpass filter. Author

N69-40332*# Techtran Corp., Glen Burnie, Md.

SOME QUESTIONS ON THE THEORY OF POTENTIAL VARIATION OF ELECTRODE LAYERS [NEKOTORYYE VOPROSY TEORII PRIELEKTRODNOGO SLOYA IZMENENIYA POTENTIALA]

G. A. Lyubimov Washington NASA Oct. 1969 10 p Transl. into ENGLISH from Zh. Prik. Mekham. i Techn. Fiz. (Moscow), no. 4, 1964 p 10 – 15

(Contract NASw-1695)

(NASA-TT-F-12531) Avail: CFSTI CSCL 20C

An analysis is presented of a clarification of the theory of the electrode layer, developed in preceding works. The clarification is performed on the basis of a consideration of ionization by impact, which creates electrons, accelerated in the electrode layer on the outer boundary of the layer. The conclusions obtained are compared with a simplified electrode layer theory and experimental data from another work. The theory presented in this work is shown to be superior to those of earlier works. Author

N69-40340 Purdue Univ., Lafayette, Ind.

A STUDY OF RADIATIVE CHARACTERISTICS OF CONDENSED GAS DEPOSITS ON COLD SURFACES

Richard Lloyd Merriam (Ph.D. Thesis) 1968 198 p

Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-2957

An analytical and experimental investigation of the radiative characteristics of condensed gas deposits on cold surfaces is presented. Results of the investigation are relevant not only to low temperature applications but may have utility for other situations as well. The analysis could be useful in predictions of radiative characteristics of dielectric coatings, for example. In addition, the experimental results provide a test of the validity of radiation transfer theory upon which analytical predictions are based. An attempt was made to keep the analysis general. Absorbing, emitting and scattering media bounded by diffuse and specular surfaces were considered. Both gray and nongray models were treated and effects of different scattering functions were discussed. Results are presented for reflectance and absorptance of deposits with diffuse or a collimated incident radiation. Dissert. Abstr.

N69-40448# Lockheed Missiles and Space Co., Palo Alto, Calif.

ACOUSTIC WAVE SCATTERING BY A SPHERE IN A SEMI-INFINITE DOMAIN

Iu. Krivonos et al 1969 5 p refs Transl. into ENGLISH from Dopo. Akad. Nauk. Ukr. RSR, Ser. A (Kiev), no. 7, 1969 p 632 – 635

Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The solution of the scattering problem for the far field at long wavelengths was constructed using the method of representations, which is convenient when one domain boundary is a plane. Author

N69-40495# North Carolina State Univ., Raleigh. Mechanical and Aerospace Engineering Dept.

AN APPROXIMATE MATHEMATICAL MODEL FOR FREE VIBRATIONS OF THE CLASS 2 FLEXTENSIONAL UNDERWATER ACOUSTIC TRANSDUCER SHELL

Jack N. Boone and Larry H. Royster Jun. 1969 34 p refs

(Contract Nonr-486(11))

(AD-691828; TR-6) Avail: CFSTI CSCL 20/1

An approximate mathematical model for free vibrations of the Class II Flextensional underwater acoustic transducer shell is presented. The energy expressions and equations of motion for symmetric modes of vibration of the shell are developed in detail. Author (TAB)

N69-40500 Washington Univ., Seattle.

MAGNETOFLUIDDYNAMIC ATTENUATION OF SOUND IN HIGH-TEMPERATURE NOZZLE EFFLUX

Jose Alcarez Sepulveda (Ph.D. Thesis) 1968 325 p

Avail: Univ. Microfilms: HC $14.65/Microfilm $4.20 Order No. 69-2444

A new concept of aerodynamic sound suppression called magnetoaerosonics is presented. The science of magnetoaerosonics utilizes the forces and effects derived from the interactions of an electromagnetic field with a moving, electrically-conducting fluid to influence the generation and propagation of pressure waves or sound waves. The foundation of this new concept is built on two important branches of science, namely; aerosonics and magnetofluiddynamics. The first portion is concerned with aerosonics and gives the definitions and explanations of the various mechanisms which are responsible for the conversion of the kinetic energy of a fluctuating fluid flow into the acoustic energy of the oscillating particles at the sound source and in the radiation field. The two most important elements of magnetofluiddynamics are the electrical properties of the fluid media and the characteristics of the electromagnetic configuration used. Experimental results compare very well with theoretical predictions. Dissert. Abstr.

N69-40577# Rome Univ. (Italy). Inst. of Physics.

ON THE MICROSCOPIC FOUNDATION OF SCALING LAWS

C. Di Castro and G. Jona-Lasinio 5 May 1969 6 p refs Prepared jointly with Ist. Nazl. Fis. Nucl. *Its* Nota Interna 222

Avail: CFSTI

In this note it is shown that the multiplicative renormalization group provides a microscopic foundation and a natural approach to scaling theory. Author (ESRO)

N69-40596# Stanford Univ., Calif. Dept. of Mathematics.

ON THE THEORY OF KIRCHHOFF'S METHOD FOR THE DETERMINATION OF ELECTRICAL CONDUCTIVITY

Harold Levine 5 Aug. 1969 29 p refs

(Contract Nonr-225(74))

(AD-691792; TR-14) Avail: CFSTI CSCL 20/3

A measure of unification is achieved for the purpose of analyzing the steady current flows through elongated cylinders of general section. These are activated by a pair of thin electrodes on the end faces and are relevant to a scheme of Kirchhoff for determining the electrical conductivity of homogeneous materials, and is manifest by the central role of a harmonic Greens function which satisfies a Neumann condition on the boundary of an infinitely long duct whose section duplicates that of the appropriate cylinder. The utility of a Greens function formalism is brought out

with specific numerical details in the respective cases of circular and square cylinder section. Author (TAB)

N69-40625# North Carolina State Univ., Raleigh. Center for Acoustical Studies.
ON THE EIGENVALUES OF AN UNTAPERED AND TAPERED HORIZONTALLY GUIDED CURVED BEAM
Larry H. Royster and Jack N. Boone. Jul. 1969. 19 p. refs
(Contract Nonr-486(11))
(AD-691829; TR-7; CAS-47) Avail: CFSTI. CSCL 20/1

The report presents typical eigenvalues for the Class I type of flextensional underwater acoustic transducer shell. The mathematical model utilized is briefly discussed and the eigenvalues obtained for an untapered and tapered horizonatally-clamped circular curved beam at various opening angles are presented in graphical form. Author (TAB)

N69-40724# North Carolina State Univ., Raleigh. Center for Acoustical Studies.
DEVELOPMENT OF A MATHEMATICAL MODEL FOR THE CLASS V FLEXTENSIONAL UNDERWATER ACOUSTIC TRANSDUCER SHELL Technical Report, 1968 - 1969
Ralph A. Nelson, Jr. and Larry H. Royster. Jun. 1969. 80 p. refs
(Contract Nonr-486(11))
(AD-691830; TR-8; CAS-45) Avail: CFSTI. CSCL 20/1

The flextensional underwater acoustic transducer concept is presently undergoing extensive analytical evaluations. In general, the various flextensional designs can be placed in one of five different classes. This report describes an analytical model developed for the Class V flextensional underwater acoustic transducer shell. Flextensional transducer designs were originally proposed as having possible applications as sonobuoy transducers. This type of design consists of two shallow spherical shells bonded at a boundary and a thin piezoelectric disk joined at this boundary by utilizing an epoxy cement. The piezoelectric disk is isolated electrically from the two shells by removing the silver electrodes beyond the region of contact between the shells and the ceramic disk. Author (TAB)

N69-40744# Pennsylvania State Univ., University Park. Ordnance Research Lab.
UNDERWATER SOUND SIGNATURES OF FLIGHT VEHICLES Status Report No. 2
W. L. Baker and J. A. Macaluso. 15 Jul. 1968. 19 p. refs
(Contract NOw-65-0123-d)
(AD-691837; Rept-25) Avail: CFSTI. CSCL 20/1

This report indicates the status of the development of a model and the analytical procedures to achieve accurate calculations of the underwater sound field characteristics of flight vehicles that operate over typical sea surfaces. Theoretical and experimental refraction studies involving acoustic plane-waves incident on a corrugated interface have resulted in a suitable mathematical model. Comparisons of the model and computations with experiment and theory for the underwater sound field resulting from plane-wave insonification of a flat, square section of the interface showed good agreement at 16 kHz and satisfactory agreement at 7 to 8 kHz. A more general model is being formulated to permit accurate simulation of the incident sound field produced by flight vehicles and to extend the definition of rough surface to one of virtually any configuration. Author (TAB)

N69-40783 European Organization for Nuclear Research, Geneva (Switzerland). Intersecting Storage Rings Div.
HIGH FREQUENCY EFFECTS ON THE TRANSVERSE RESISTIVE WALL INSTABILITY IN PARTICLE STORAGE RINGS
B. Zotter. 9 Jun. 1969. 60 p. refs
(CERN 69-16) Avail: Issuing Activity

The transverse resistive wall instability in particle storage rings is calculated for high frequencies, for which the wavelength is no longer large compared to the transverse dimensions of the vacuum chamber. A circular beam in a concentric vacuum chamber is considered for the calculation of the field components caused by a vertical oscillation of the beam as a whole (dipole oscillation). It is shown that the average electromagnetic force which acts on the beam as a whole, decreases with increasing frequency. In consequence, the dispersion relation coefficients U and V decreade with increasing frequency. Further, the frequency spread due to energy and amplitude dependence of betatron number and revolution frequency increases with frequency above a certain mode number, which usually lies well in the long wavelength region. Instability thresholds and growth times will therefore increase in the high frequency region, and a beam that is stable against dipole oscillation in the long wavelength limit will also be stable at high frequencies. Numerical values are inserted for the parameters of the intersecting storage ring, and the decrease of the dispersion relation coefficients is shown graphically. Author

N69-40839# Technische Hochschule Munchen (West Germany).
ULTRASONIC DAMPING IN EXCHANGE-REINFORCED METALS FOR T EQUALS O AND IN FERROMAGNETS FOR TEMPERATURE GREATER THAN CRITICAL TEMPERATURE IN THE BAND MODEL [ZUR ULTRASCHALLDAEMPFUNG IN AUSTAUSCHUERSTAERKTEN METALLEN FUER T EQUALS O UND IN FERROMAGNETEN FUER T GREATER THAN T SUB C IM BAENDERMODELL]
Klaus Gehring (Ph. D. Thesis). 1969. 26 p. refs. In GERMAN
Avail: CFSTI

Excitations with a range relevant to ultrasonic damping are considered, i.e., the conduction electrons in case of $T \approx 0$. The indirect effect of spin fluctuation (via conduction electrons) on sonic damping is examined, and it is shown that the fluctuations equally affect electrical conductivity and sonic absorption since both are essentially determined by the mean free path or the lifetime of the conduction electrons. At the critical point, these excitations are in fact the spin fluctuations. In order to overcome the inconsistency of the RPA in the critical range, a consistent treatment of the d-electrons by means of the shielded-potential approximation is attempted. Transl. by K.W.

N69-40875*# California Univ., La Jolla. Dept of Applied Physics and Information Science.
RESOLVABILITY OF OBJECTS FROM THE STANDPOINT OF STATISTICAL PARAMETER ESTIMATION
Carl W. Helstrom. [1969] 30 p. refs
(Grant NGR-05-009-079)
(NASA-CR-106404) Avail: CFSTI. CSCL 17H

The values of the radiance at points of an incoherently radiating object are considered as parameters of the statistical description of the field at the aperture of an observing optical instrument. By means of the Cramer - Rao inequality a lower bound is set to the mean-square errors of unbiased estimates of the radiance values. The errors are shown to increase rapidly when the object is sampled at points separated by less than a conventional resolution interval. Author

N69-40886 Brandeis Univ., Waltham, Mass.
SMALL DISTANCE BEHAVIOR AND HIGHER SPINS IN QUANTUM FIELD THEORY
Janett Trubatch (Ph.D. Thesis). 1968. 214 p.
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00. Order No. 69-2067

The small distance properties of local field theories are investigated in terms of the equal time commutators of the physically observable currents and stress tensor components. The discrepancies between the vacuum expectation values of these commutators as calculated directly from the canonical commutation rules and their values as calculated by using the Lehmann-Kallen spectral form can be attributed to the undefined nature of the currents as the product of operator valued distributions at a point. For the Dirac current the paradoxes are resolved by making a space-like spreading in the operator products which appear in the Lagrangian as opposed to an ad hoc spreading in just the current.

The spreading is done without distrubing the CCR and Noether's theorem is used to obtain the conserved current. Although for Bose currents no a priori inconsistencies arise, space-like spreading may still be necessary in order to define the current in a less singular manner. Dissert. Abstr.

N69-40891 Arizona Univ., Tucson.
COLLISION PHENOMENA OF UNCHARGED WATER DROPS IN A VERTICAL ELECTRIC FIELD
David N. Montgomery (Ph.D. Thesis) 1968 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-2014

The general charge separation mechanism of collison and subsequent separation of drops in an electric field was studied in a vertical wind tunnel which would stably support water drops. A voltage was applied between horizontal electrodes bounding the test region, establishing a vertical electric field in the region where the collisions occurred. It was found for the drop size used in the experiment the dynamics of the individual collisions were more important than the electric field in determining permanent coalescence. Collisions were recorded in which the drops collided head-on, flattened and coalesced, then oscillated and elongated vertically. A model was developed based on the excess surface energy of the distorted drop shapes over that of the equivalent volume spherical shape. It described the observed oscillation and predicted separation of drops initially flattened beyond a limit. The drop charging observed in the experiment is compared to that recorded for naturally occurring rain and found to agree well with the features exhibited by this phenomenon. Dissert. Abstr.

N69-40958# Woods Hole Oceanographic Institution, Mass.
VARIABLENESS OF THE SOUND VELOCITY PROFILE ABOUT THE MID-ATLANTIC RIDGE AXIS
Eli Joel Katz Jun. 1969 21 p refs
(Contract Nonr-4029(00))
(AD-691379; Rept-69-50) Avail: CFSTI CSCL 20/1

Mediterranean Water, spreading across the North Atlantic Ocean, is shown to cause a disturbance to the acoustic medium in the vicinity of the Mid-Atlantic Ridge north of the Azores. In this region, the ridge crests are sufficiently shallow so as to impede the free movement of the intermediate waters. Warm and saline layers, nearly two hundred meters thick, were repeatedly observed in the lowering of continuous sampling sensors. These inversion layers are shown, by reconstruction, to result from local water movement across the ridge crest and are argued to be short lived and spatially confined. As a direct consequence the observed depth of the sound velocity minimum unpredictably fluctuated as much as five hundred meters within an area of two hundred miles square. The layers themselves result in secondary sound channels. The inversions of both temperature and salinity combine to produce inversions in the sound velocity profile of four meters per second, deep in the thermocline. Author (TAB)

N69-40969# Princeton Univ., N.J.
UNIFIED THEORY OF SPHERICALLY SYMMETRIC SPACE-TIME: A NEW FORMULATION
Joseph Peter Vajk (Ph.D. Thesis) 1968 198 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-2567

A general formalism for spherically symmetric spacetimes containing idealized matter and electromagnetic sources and fields (but not spherically symmetric geons) is developed. It is shown that a spherically symmetric spacetime can be decomposed into a disjoint union of subsets of five distinct types. On subsets of the first four types, $r \neq 0$, while $\partial_\mu r$ is spacelike, timelike, or null, or vanishes. Subsets of the fifth type are characterized by $r = 0$. Invariant procedures are given for constructing orthogonal coordinate systems on subsets of the first four types, and the most general forms of the metric are found in terms of those coordinate systems. A new theorem, extending Birkhoff's theorem to the electromagnetic case, and a variety of exact cosmological solutions containing idealized matter and, in one case, electromagnetic fields are derived. Thirteen of these solutions are of the Robertson-Walker type (six of these are new) and are spatially homogeneous and isotropic. Dissert. Abstr.

N69-40987# Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.
SHOT SOURCE SPECTRA AND BOTTOM REFLECTIVITY DATA
Wilton A. Hardy Apr. 1969 92 p refs
(Cohtract Nonr-266(84))
(AD-691397; TR-179) Avail: CFSTI CSCL 20/1

Underwater explosive shot spectra are given for 1-lb TNT shots detonated at depths from 200 to 14,000 ft. Bottom reflections from some of these shots were monitored by hydrophones of the Hudson Laboratories vertical array, and the signals were cross correlated across pairs of hydrophones with a 500-ft spacing. The experiment occurred in deep water with an average depth of 2600 fathoms at, roughly, 20 deg 05 min N, 59 deg 54 min W, i.e., in the southern section of the North American Basin. Author (TAB)

N69-40997# Lockheed Missiles and Space Co., Palo Alto, Calif.
PROPAGATION OF LIGHT BEAMS IN INHOMOGENEOUS ANISOTROPIC MEDIA
N. A. Gusak et al [1969] 5 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 11, no. 2, 1969 p 237–241
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

To simplify the problem, a two-dimensional beam propagated in a uniaxial crystal (or in one of the principal planes of a biaxial crystal) is considered. Assuming that the optical axis of the crystal lies in the xz plane and that the beam field is independent of coordinate y, Maxwell equations for extraordinary waves are derived. If the direction of the energy flux of a beam entering an inhomogeneous anisotropic medium coincides with the axis of inhomogeneity, the beam being propagated along this axis only changes its transverse dimensions. If the initial direction of the energy flux does not coincide with the axis of inhomogeneity, the beam is first deflected from this axis by the effect of the anisotropy, and then returns. Its subsequent motion is performed along a sinusoidal curve. R.B.

N69-41010# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON ELECTROMAGNETIC WAVE DIFFRACTION BY TWO ELLIPTIC CYLINDERS
E. A. Ivanov et al [1969] 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk Belorussk. SSR, Ser. Fiz.-Mat. Nauk (Minsk), no. 4, 1969 p 5–11
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The amplitude function radar cross-section for two ideally conducting parallel elliptic cylinders were computed. The mutual orientation of the cross-sectional ellipses of the cylinders and their ellipticity affect the magnitude of the principal maximum of the reradiated field. The selection of spacing l between the cylinders and selection of cross-sectional ellipse size and orientation can be an efficient means of minimizing or optimizing the radar cross-section of a reflector consisting of two elliptic cylinders or strips. The directivity patterns of a reradiated field in the presence of two elliptic cylinders are of lobal character, where the number of pattern lobes increases as l grows. The nature of the directivity pattern and the reradiated field intensity depend on the electrical dimensions of the cylinder diameters. A change in orientation of the cross-sectional ellipses of the cylinders permits controlling the system scattering characteristics without relying on a change in the incident field frequency or the electrical dimensions of the cylinders. R.B.

N69-41025*# California Univ., Berkeley. Space Sciences Lab.
A RADIALLY INHOMOGEOUS MOON IN A PLANE ELECTROMAGNETIC FIELD Final Report
B. D. Fuller and S. H. Ward. Sep. 1969. 29 p. refs.
(Contract NAS2-5242)
(NASA-CR-73382) Avail: CFSTI. CSCL 20C

The utility of a layered model to simulate a planet is usually based upon the assumption that a continuous distribution of electrical properties may be approximated by an arbitrarily large number of discrete layers. An investigation of this assumption is reported for a particular conductivity distribution, illustrating the convergence of the layered model solution to the solution for a sphere with a conductivity which is functionally dependent upon the radial coordinate r. This work is intended to justify the utility of layered models in theoretical computations which are directed toward the goal of estimating the electrical parameters of the inner moon by observing the behavior of the natural time varying magnetic field in the lunar environment. The problem is considered only as it pertains to spherical geometry and low frequencies, such that the wavelength in the lunar sphere is of the order of the dimension of the sphere. Author

N69-41032# Academy of Sciences (USSR), Moscow.
WAVE EQUATIONS APPROXIMATING THE PRECISE SOLUTIONS FOR NONLINEAR ELECTRODYNAMICS AND OPTICS
J. M. Eleonskii and V. P. Silin. 1969. 42 p. refs. In RUSSIAN
(NP-17915) Avail: AEC Depository Libraries

Asymptotic solutions of nonlinear field equations were obtained for singular values of wave vectors in the case in which one-mode solutions by amplitude steps were impossible. Moreover, the above demanded solutions of nonlinear one-dimensional equations for the fundamental mode, and in one case, the use of several harmonic modes. Two-dimensional solutions were constructed for approximating the exact nonlinear periodic one-dimensional waves and the possible wave vector values were found. Author (NSA)

N69-41217# Academy of Sciences (USSR), Moscow. Inst. of Physics.
MAGNETIC FIELD STRUCTURE OF A TYPE L-1, TWO-PASS STELLARATOR
A. V. Komin, L. V. Krasitskaya, V. P. Minaev, L. M. Kovrizhnykh, and I. S. Danilkin. 1969. 21 p. refs. In RUSSIAN. *Its* Preprint No. 35
(NP-17948) Avail: AEC Depository Libraries

The structure of magnetic surfaces in the peripheral region (near the separatrix) was carried out more accurately by direct calculation of trajectories of the force lines on a computer. The calculations were carried out for the following variants: (1) a system of magnetic surfaces of a toroidal stellarator created by two different ways of winding the coils (geodesic and quasitoroidal spirals), and (2) the effect of a number of perturbations on the magnetic surfaces of the field. The main perturbation was taken as skewing of the current distribution planes created by the longitudinal and helical field. A horizontal magnetic field was also added as a perturbation along with the perturbation due to skewing. A comparison of these results with previous results in the literature shows that the two sets of results are in good agreement with each other. Computer computations are preferred only when exact, quantitative data on a concrete system are desired. NSA

N69-41305# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
NONLINEAR WAVE PROPAGATION IN THE GEOMETRICAL APPROXIMATION
Frederic E. Bisshopp. Apr. 1969. 89 p. refs.
(Contract Nonr-562(42))
(AD-691779; TR-9) Avail: CFSTI. CSCL 20/6

A geometrical theory of nonlinear wave propagation is developed for a class of stationary principles which includes some models of nonlinear optics. The geometrical approximation differs from the Quasi-optical approximation in a number of ways, including the fact that it can be shown to be the first of a rational sequence of approximations. The geometrical approximation is derived here in one of several ways it might have been introduced, and a number of its predictions are worked out in detail. Stability of a nonlinear beam, qualitative aspects of its propagation in the steady state, and specific examples that illustrate the effect of different kinds of nonlinearity are discussed. Finally, a nonlinear stationary principle for electromagnetic theory is proposed, and the qualitative features of the corresponding geometrical nonlinear optics are discussed. Author (TAB)

N69-41316 Rensselaer Polytechnic Inst., Troy, N.Y.
RAY TRANSMISSIONS IN UNDERWATER ACOUSTIC DUCTS HAVING RANDOM BOTTOMS
Arnold David Seifer (Ph.D. Thesis). 1968. 129 p.
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00. Order No. 69-2480

The principles of geometrical optics are applied to a study of ray acoustics in an isovelocity sound channel bounded by a lossy, pseudorandom (facet) bottom below and a free, planar surface above. A point source and receiving point are fixed and in a plane normal to the bottom so that all rays between them are coplanar. Effects of boundary loss and phase-shift, geometrical spreading loss, and travel time are included and bottom-reflected arrivals are shown to be almost constant in amplitude but incoherent in phase. Graphs are presented giving the mean and standard deviation of the sound-field intensity for various source and receiving point geometries. A general spreading-loss equation is developed for specularly reflected rays in a medium whose sound velocity varies with depth and whose bottom has one-dimensional roughness with curvature. It is found that curvature can cause significant amplitude variation, which might otherwise be negligible if curvature were neglected. The spreading loss is determined for a layered medium bounded by a bottom with curvature. Dissert. Abstr.

N69-41325 Rensselaer Polytechnic Inst. Troy, N.Y.
SCATTERING OF ACOUSTIC AND ELASTIC WAVES BY A SPHERICAL INCLUSION
Robert David Sidman (Ph.D. Thesis). 1968. 100 p.
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00. Order No. 69-2482

Discussed are two similar types of dynamic problems in acoustics and elasticity. A rigid moveable sphere that is part of a mass-spring-dashpot system is constrained to move with one degree of freedom in an acoustical medium. In the first case, the inclusion is displaced by an incident plane wave, and in the second, by a spherical wave produced by a point source. These displacements are completed for various values of $\delta = \rho/\rho_0$, the ratio of the mass density of the inclusion to the mass density of the medium. The motion of the sphere is assumed to be small. It is then shown that the inverse problem of determining the type of incident disturbance from knowledge of the motion of the sphere along is not well-posed. A plane wave with a properly chosen profile will produce the same response as a given point source. Dissert. Abstr.

N69-41361# Akademiya Nauk URSR, Kharkov. Fiziko-Teknicheskii Institut.
MAGNETIC CONFIGURATION WITH WIDTH AND MINIMUM B
V. F. Aleksin, S. S. Romanov, V. P. Sebko, and Yu. M. Loktionov. 1968. 17 p. refs. In RUSSIAN
(FTI-217) Avail: AEC Depository Libraries

Studies were made of magnetic configuration of one-, two-, and three settings of the helical field (n = 1, 2, and 3) with axial current. Properties of rotational transformation of magnetic lines of force and magnetic field minimum at the center were examined. A relationship was established for the well and width and the particularities of the structure configuration. Numerical data were

obtained for the width and relative depth of wells for each magnetic system (n = 1, 2, and 3). Author (NSA)

N69-41388 National Lending Library for Science and Technology, Boston Spa (England).
OPTICAL MATERIALS FOR THE ULTRA-VIOLET AND INFRA-RED SPECTRAL REGION
H. Schroeder et al. 18 Jul. 1969 24 p refs Transl. into ENGLISH from Optik (Stuttgart), v. 26, no. 4 1967/1968 p 381-401 Presented at DGaO Conf., Mainz, 1967
(NLL-PORS-Trans-2564-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: .3 NLL Photocopy coupons

The paper reviews the materials at present available for optical transfer of radiation in the infra-red and ultra-violet regions and summarizes their most important characteristics and uses. The following materials are discussed: (1) special glass types of high UV or IR transmission; (2) monocrystals; (3)polycrystalline and semiconductor materials; (4) UV optic fibers; and (5) multilayers for mirror optics in the far UV. Author

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N69-40002# Stanford Linear Accelerator Center, Calif.
RECENT BEAM PERFORMANCE AND DEVELOPMENTS AT SLAC
R. H. Helm, H. A. Hogg, R. F. Koontz, G. A. Loew, R. H. Miller et al. Mar. 1969 5 p refs Presented at Natl. Particle Accelerator Conf., Washington, D.C., 5 - 7 Mar. 1969
(SLAC-PUB-563; CONF-690308-6) Avail: CFSTI

The recent developments at SLAC which have contributed to improvements in beam operation are described. The overall beam performance and operational efficiency in delivering beams to various experiments are summarized. Specific developments such as the achievement of higher energies, increasingly narrow energy spectra, higher beam breakup current thresholds, chopped beams and improvements in pulse-to-pulse operation are discussed. A description of various new pulsed devices such as pulsed quadrupoles, improvements in the positron source and new beam loading measurements obtained for very short pulses is included. Author (NSA)

N69-40003# Louisiana State Univ., Baton Rouge. Dept. of Chemistry.
SPECTROSCOPY OF SOME SMALL HIGH SYMMETRY MOLECULES AND OXYANIONS
Thomas Harold Brayden, Jr. (Ph.D. Thesis) Aug. 1968 111 p refs Sponsored by AEC
(ORO-3018-44-A) Avail: CFSTI

The approach to solving the problem involves using certain computational methods and comparing the results obtained with experiment. Some of the shortcomings of the calculational routine are listed and their consequent effect on the reliability of the calculated values is also discussed. The results of the calculational efforts are used to construct quantitative Walsh energy level diagrams and to determine the charge distributions in the molecules/ions studied. The quantitative diagrams were compared with published qualitative Walsh energy level diagrams. Development of these qualitative diagrams using group theory is presented. The charge distributions in the molecules/ions studied were correlated with their lowest-energy electronic transitions. Experimental electronic spectra are presented and the interpretation of these is compared with those available in the scientific literature. Predictions utilizing the quantitative diagrams were made for 18, 24, and 26 electron entities. Author (NSA)

N69-40008# Kernforschungszentrum, Karlsruhe (West Germany).
THE INFLUENCE OF NUCLEAR DATA UNCERTAINTIES ON PROPERTIES OF CRITICAL ASSEMBLIES
C. H. M. Broeders Jan. 1969 19 p refs
(KFK-939; EUR-3956) Avail: AEC Depository Libraries

The influence of the uncertainty of ^{238}U capture cross section and ^{235}U fission cross section on the design parameters of steam-cooled fast reactors is analyzed. Fundamental mode calculations for two critical assemblies are presented: the SNEAK 3A-2 uranium fueled assembly with soft neutron spectrum; and the ZPR 3-48 plutonium fueled assembly with hard neutron spectrum. Author (NSA)

N69-40013# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
ANOMALY ARISING IN THE COLLAPSED GROUP FLUX SYNTHESIS APPROXIMATION
C. H. Adams and W. M. Stacey, Jr. 17 Jun. 1969 10 p refs Presented at the 15th Ann. Meeting of the Am. Nucl. Soc., Seattle
(Contract W-31-109-Eng-52)
(KAPL-P-3811; CONF-690609-12) Avail: CFSTI

An anomaly arising from a flux-weighted collapsed-group synthesis calculation for an annularly-rodded cylindrical core is discussed. Results from using expansion functions as weighting shapes are described; these results are compared with actual values. Behavior of the calculated fluxes is analyzed; reasons for the behavior of the flux anomaly are explained. NSA

N69-40021# Commissariat a l'Energie Atomique, Saclay (France).
ACCELERATION OF HEAVY IONS IN A VARIABLE FREQUENCY CYCLOTRON AT SACLAY THROUGH USE OF A TROCHOIDAL INJECTOR
G. Knittner, R. Maillard, A. Papineau, H. Possard, and C. Re 1969 7 p In FRENCH Presented at the Conf. on the Phys. and Prod. of Heavy Ions, La Plagne, France
(CEA-CONF-1260; CONF-690314-2) Avail: AEC Depository Libraries

The heavy ion source at Saclay is of the large cathode surface arc type and will produce multicharged ions of Ne, O, N, C, and Li. The trochoidal apparatus for the injection of polarized protons is used for the injection of the heavy ions. In order to penetrate into the trochoidal injector, the ions are focused by a quadrupole and deflected to 45° by a magnet. This arrangement permits either heavy ions or polarized protons to be used in the cyclotron. The heavy ion beam can attain a maximum energy above 50 MeV. NSA

N69-40023# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
ISOLATION OF Pm-147 BY RAPID CATION EXCHANGE CHROMATOGRAPHY
J. T. Lowe Jul. 1969 29 p refs
(Contract AT(07-2)-1)
(DP-1194) Avail: CFSTI

A rapid cation exchange process was developed to separate ^{147}Pm from other fission product lanthanides by displacement development chromatography. Flow rates four times those used in conventional gravity-fed systems were achieved in pressurized columns containing small particle resin. Author (NSA)

N69-40025# Brookhaven National Lab., Upton, N.Y.
EXPERIMENTAL STUDY OF THE HORIZONTAL HALF INTEGRAL CORRECTIONS IN THE AGS

J. C. Herrera. 15 May 1969. 26 p. refs.
(BNL-13711) Avail: CFSTI

In the AGS there are a total of 24 quadrupoles, 12 located at each of the "17" straight sections where the horizontal beta function is a maximum, and 12 located at each of the "3" straight sections where the vertical beta function is a maximum. Normally, 4 of the horizontal quadrupoles at positions C-17, F-17, I-17, and L-17 are powered for approximately 25 msec during the early part of the acceleration cycle when the horizontal ν value of the particles passes through the critical value of 8-1/2. The theory of how such added perturbing gradients correct for the non-superperiod symmetric gradient errors present in the machine has been discussed previously. The purpose of this experiment was to study the extent to which this theory was applicable to the actual AGS gradient corrections. It was found that the magnitude of the horizontal half integral corrections are consistent with the first order perturbation theory, and that the presence of terms which are of second order in the perturbing gradient does not influence the adjustment of these corrections. NSA

N69-40032# Du Pont De Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
SEPARATION OF Tm-171 FROM IRRADIATED ENRICHED ERBIUM
William H. Hale, Jr. May 1969. 18 p. refs.
(Contract AT(07-2)-1)
(DP-1183) Avail: CFSTI

A chromatographic cation exchange process was developed to separate ^{171}Tm from irradiated enriched erbium. Thirty-eight mg of pure thulium were separated from a 1-gram sample of irradiated 170 Er_2O_3. Author (NSA)

N69-40037# International Centre for Theoretical Physics, Trieste (Italy).
MESON-BARYON SCATTERING LENGTHS FROM CHIRAL SU(3) × SU(3) EFFECTIVE LAGRANGIANS
A. M. Harun-Ar Rashid. Aug. 1969. 18 p. refs. Submitted for publication
(IC/69/84) Avail: CFSTI

Using the technique of Wess and Zumino for constructing the chiral SU(3) × SU(3)-invariant effective Lagrangians, the meson-baryon scattering lengths are studied. The introduction of N*-resonance is straightforward in this method and its contribution to the scattering lengths is found by a consideration of the tree diagrams. The difficulty with regard to the bad asymptotic behavior found by Peccei is shown not to be present in this method. The method is also applied to KN scattering where the Gell-Mann, Oakes and Renner type symmetry breaking is found to be quite significant. Author (ESRO)

N69-40043# California Univ., Lawrence Radiation Lab.
SPACE CHARGE EFFECTS IN THE AXIAL INJECTION LINE FOR THE 88-INCH CYCLOTRON
F. Resmini and D. J. Clark. May 1969. 13 p. Presented at Particle Accelerator Conf., Washington, D.C., 5–7 Mar. 1969. Sponsored by AEC
(UCRL-18596; CONF-690308-7) Avail: CFSTI

Results of space charge calculations for higher beam intensities in the new axial injection beam transport line for the Berkeley 88-inch cyclotron are presented and discussed. NSA

N69-40044# California Univ., Berkeley. Lawrence Radiation Lab.
EXTRACTION AND TRANSFER OF HIGH-QUALITY BEAMS FROM SYNCHROTRONS OF THE FOOFDOD TYPE WITH APPLICATION TO THE OMNITRON
Philip F. Meads, Jr. and Frank B. Selph. Feb. 1969. 16 p. refs. Presented at Particle Accelerator Conf., Washington, D.C. (Contract W-7405-Eng-48)
(UCRL-18781; CONF-690308-5) Avail: CFSTI

Acceleration of ions of low charge-to-mass ratio in the Omnitron is accomplished in two acceleration cycles with the beam transferred between the synchrotron and the concentric storage ring between cycles. Successful tandem acceleration requires that the beam quality be maintained through each ring-to-ring transfer. The extraction method described provides a ring-to-ring match in both betatron phase planes, including dispersion. Maximum efficiency is obtained from the deflecting magnets as a consequence of both kicking and extracting at the point of maximum radial betatron amplitude. The beam path and focusing are chosen to minimize the aberrations due to passing through the extreme fringing magnet in the accelerator gradient magnets. This requires a special focusing magnet in the accelerator extraction line and the shimming of two storage ring gradient magnets. Author (NSA)

N69-40049# Stanford Univ., Calif.
PRODUCTION OF POLARIZED ELECTRON BEAMS
K. Jost and H. D. Zeman. Apr. 1969. 85 p. refs.
(Contract Nonr-225(67))
(AD-690762; HEPL-590) Avail: CFSTI CSCL 20/8

A survey of proposed and working methods for producing spin polarized electron beams is presented. An effective intensity and an effective brightness for sources of polarized electrons are derived. These quantities serve as figures of merit to compare the utility of the sources presently available. Author (TAB)

N69-40064# Academy of Sciences, Moscow (USSR). Inst. of Atomic Energy.
RELAXATION LENGTHS IN WATER
Kh. Sh. Abdullaev, V. D. Nikitin, and G. Ya. Trukhanov. 1968. 22 p. refs. In RUSSIAN; ENGLISH summary
(IAE-1612) Avail: AEC Depository Libraries

The meaning of relaxation lengths which appear in various methods of solution of the transport equation is discussed. The relation between so-called relaxation length of the temperature of a neutron gas and the first relaxation length of neutron flow is deduced. Methods are proposed for obtaining the first relaxation length from the experimental space-energy distribution of thermal neutrons. These methods are used for the analysis of experiments in the graphite-water system with a temperature discontinuity at the interface between media. From the activation measurements the fundamental ($\approx$3 cm) and first ($\approx$0.46 cm) relaxation lengths in water are obtained. The value of the relaxation length obtained from the asymptotic part of the experimental distribution of the temperature of the neutron gas in water is $\approx$0.27 cm. The question on the existence of the first discrete or quasidiscrete relaxation length in water is discussed. Author (NSA)

N69-40065# Academy of Sciences, Moscow (USSR). Inst. of Atomic Energy.
RETHERMALIZATION LENGTHS IN GRAPHITE AND IN WATER [DLINY RETERMALIZATSII V GRAFITE I V VODE]
Kh. Sh. Abdullaev, V. D. Nikitin, and G. Ya. Trukhanov. 1968. 24 p. refs. In RUSSIAN; ENGLISH summary
(IAE-1613) Avail: AEC Depository Libraries

Methods for obtaining rethermalization lengths from the experimental space-energy distribution of thermal neutrons are developed. Using these methods, rethermalization lengths in graphite and water (graphite temperature 133 and 443°K, water temperature $\approx$300 and 343°K) were calculated on the base of the experimental data for graphite-water system with a temperature discontinuity at the interface between the media. It was found that the rethermalization length in graphite depends slightly on the temperature of the neighbor zone and rather strongly depends on the graphite temperature (the latter phenomenon indicates that

chemical bonds play a significant role in graphite at low temperature). The data are in good agreement with results of other authors. Rethermalization lengths in water obtained by different methods for a single experiment differ noticeably from each other, which shows nonuniversality of such neutron-physical characteristics of water as the rethermalization length. Author (NSA)

N69-40069# Oak Ridge National Lab., Tenn. Office of Language Services.

INTERACTION OF BEAMS OF CONDENSED MOLECULES WITH SOLID SURFACES

E. W. Becker et al [1968] 11 p refs Transl. into ENGLISH from Z. Naturtorsch. (Tubingen), no. 23A, 1968 p 274–279 Supported by AEC

(ORNL-TR-2184) Avail: CFSTI

The reflection of a beam of nitrogen clusters from a polished stainless steel surface is investigated. The scattered flux shows a strong maximum at an angle of reflection of nearly 90°, independent of angle of incidence. The mean velocity of the reflected beam is about equal to the tangential velocity component of the incident beam. Measurements with increased background pressure demonstrate that the reflected beam still consists essentially of clusters. Author (NSA)

N69-40073*# Denver Univ., Colo. Dept. of Physics.

IONIZATION AND METASTABLE EXCITATION IN LOW-ENERGY COLLISIONS OF GROUND STATE ARGON ATOMS

Paul O. Haugsjaa and Robert C. Amme [1969] 12 p refs

(Grant NGR-06-004-006)

(NASA-CR-106343) Avail: CFSTI CSCL 20H

A low-energy beam of argon atoms, formed by nonresonant charge transfer of Ar^+ in H_2, has been used to explore the near-threshold behavior for ionizing and exciting collisions between argon atoms. For excess center-of-mass energies below 12 eV, the ionization data are consistent with the empirical relationship $\sigma \approx 1.8 \times 10^{-21} (E - 15.8)^{1.3}$, where E is the center of mass energy in electron-volts. Target gas mixtures of argon and acetylene were used in an effort to observe metastable atoms formed in atom–atom collisions by Penning ionization. In this case, beam energies iere restricted to values less than 30 eV to avoid direct ionization of the acetylene (Penning) gas by the ground-state atom beam. At 14.5 eV c.m. energy, the cross section for metastable production is shown to be $(3.6 \pm 2.4) \times 10^{-20} cm^2$, but this value is dependent upon assumed values of the Penning cross section for Ar^* plus acetylene collisions. Author

N69-40084# Rome Univ. (Italy). Inst. of Physics.

VENEZIANO AMPLITUDE AND LORENTZ POLES

M. L. Paciello, L. Sertorio, and B. Taglienti 27 Dec. 1968 15 p refs *Its* Nota Interna No. 200

(Contract F61052-67-C-0084)

(AD-691277) Avail: CFSTI CSCL 20/8

It is shown that the s to the alpha power behaviour of the Veneziano amplitude does not correspond to the existence of a simple Lorentz pole. It is shown in detail how to restore a single Lorentz pole dominance for which is necessary to add infinite Veneziano satellites. This fact is valid both for the original Veneziano amplitude and for the Mandelstam modified amplitude. TAB

N69-40086# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimentalnoi Fiziki.

CONCERNING THE QUANTUM MECHANICAL DESCRIPTION OF "PARTICLES" WITH COMPLEX SPIN [O KVANTOVOMEKHANICHESKOM OPISANII "CHASTITS" S KOMPLEKSNYM]

V. I. Roginskii 1968 35 p refs In RUSSIAN; ENGLISH summary

(ITEF-647) Avail: AEC Depository Libraries

The concept of the direct product $T^{S_1} \otimes T^{S_2}$ of two irreducible representations (irreps) of the rotation group is generalized to the case when the weights S_1 and S_2 of these irreps are complex, but the difference $2S_1 - 2S_2$ is an integer; at such values of S_1 and S_2 the representation (rep) $T^{S_1} \otimes T^{S_2}$ is defined as the restriction of the irrep $T^{(S_1, S_2)}$ of the Lorentz group to the rotation group. The method does not enable one to consider a single irrep T^S at complex S. The definition of the rep $T^{S_1} \otimes T^{S_2}$ is used as the basis for generalization to the complex spin case of the concept of two-particle spin wave function (the spin difference $S_1 - S_2$ is to remain a half-integer) and of one-particle spin density matrix. This approach does not make possible the introduction of a wave function of a single particle with complex spin, therefore such a particle is not observable or is observable to a limited extent only. The system of two particles with complex spins may be in a state with half-integer total spin; real particles may correspond to these states. Author (NSA)

N69-40106# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.

TWO DIMENSIONAL BLACKNESS THEORY BOUNDARY CONDITIONS: RZ GEOMETRY

M. R. Mendelson, M. L. Storm, and S. A. Gazda 1969 17 p refs Presented at the 15th Ann. Meeting of the Am. Nucl. Soc., Seattle

(Contract W-31-109-eng-52)

(KAPL-P-3830; CONF-690609-9) Avail: CFSTI

A procedure is described for obtaining boundary conditions for a finite cylinder consisting of arbitrary scattering and absorbing material for use in few-group diffusion theory R-Z cell calculations. The method relies on a definition of an albedo function which relates the incident and exit currents on the surface of a body. A discrete spatial mesh is superimposed on the surface to yield a set of albedo matrices. Application of the definitions of partial currents to the albedo matrices results in the desired diffusion theory boundary conditions. Examples of the procedures and results are included. NSA

N69-40114# International Centre for Theoretical Physics, Trieste (Italy).

QUASIPOTENTIAL THEORY OF HIGH-ENERGY HADRON SCATTERING

V. R. Garsevanishvili, V. A. Matveev, L. A. Slepchenko, and A. N. Tavkhelidze Aug. 1969 37 p refs

(IC/69/87) Avail: CFSTI

A review of work carried out at Dubna on the quasipotential description of high-energy hadron scattering is presented. The scattering of two spinless particles with equal masses is considered and the connection between the quasipotential approach and that based on the Regge pole hypothesis is briefly discussed. Small-angle elastic scattering and large-angle scattering are also discussed but the spin complications and mass differences have been ignored. ESRO

N69-40131*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.

APPLICATIONS OF RADIOISOTOPES AND SUBLIMING MATERIALS FOR ATTITUDE CONTROL OF SMALL SOLAR PROBES

Phillip T. Choong (Ph.D. Thesis) and Edward A. Mason May 1969 219 p refs

(Grant NGL-22-009-019)

(NASA-CR-106331; T-69-2) Avail: CFSTI CSCL 20H

A numerical procedure for calculating the molecular flow parameters from direct physical approach has been developed and

extended to compute the mass and thrust non-obstruction factors for conic channels. The resultant molecular non-obstruction factors and the evaporation coefficients are employed in the transient thermal analyses of an erecting shell and a subliming microthruster proposed for orientation and despinning of a small solar probe. The geometry of a microthruster utilizing the subliming material and radioisotopes is optimized by the above numerical procedure. Alpha-emitting radioisotopes, in addition to supplying the heat and thrust for a microthruster, are found to improve the performance of an erecting shell designed to damp out undesired precessional motions by significantly increasing the optimum spin rate. Finally, the applications of the erecting shell and the subliming microthruster to the attitude control of the MIT's Sunblazer appear very attractive in several aspects. Author

N69-40157# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
TRANSIENT PHENOMENA DURING ELECTRON BEAM INJECTION IN THE SACLAY 45 MeV ACCELERATOR [REGIMES TRANSITOIRES A L'INJECTION DU FAISCEAU D'ELECTRONS DANS L'ACCELERATEUR 45 MeV DE SACLAY]
Jacques Marcou (Paris Univ.), Albert Papiernik (Paris Univ.), Louis Wartski (Paris Univ.), Michel Bolore, Gérard Filippi et al. Jun. 1969 65 p refs In FRENCH; ENGLISH summary Prepared jointly with Paris Univ., Orsay
(CEA-R-3842) Avail: CFSTI

The principal features of the transient phenomena occurring when electron beams are injected into a constant field linear accelerator are analysed and interpreted by the use of a simple theory. The influence of these transient phenomena on the energy of accelerated particles was observed using a relatively precise method. For very large beam currents, non-linear phenomena due to beam deformation can be detected when the electron velocity is not exactly equal to the velocity of light. Author (ESRO)

N69-40189# Rensselaer Polytechnic Inst., Troy, N.Y.
SEMI-ANALYTIC FLUX REPRESENTATION FOR FAST PULSED ASSEMBLIES
P. B. Daitch and H. N. Knickle [1969] 5 p Presented at 15th Ann. Meeting of the Am. Nucl. Soc., Seattle
(Contract AT (30-3)-328)
(RPI-328-156; Conf-690609-14) Avail: CFSTI

A calculational model for neutron flux calculations for fast pulsed assemblies is given in functional form. Assumptions made to arrive at an expression for the decay constant are summarized. The model is also extended to weakly multiplying systems. Author (NSA)

N69-40191# Academy of Sciences, Moscow (USSR). Inst. of Atomic Energy.
DETERMINATION OF THE CONCENTRATION AND SPATIAL DISTRIBUTION OF THORIUM IN MINERALS AND ROCKS ACCORDING TO THE TRACES FROM FISSION FRAGMENTS [OPREDELENIE KONTSENTRATSII I PROSTRANSTVENNOGO RASPREDELENIYA TORIYA V MINERALAKH I GORNYKH PORODAKH PO SLEDAM OT OSKOLKOV DELENIYA]
I. G. Berzina, M. Yu. Gurvich, and G. I. Khlebnikov 1968 8 p refs In RUSSIAN
(IAE-1519) Avail: AEC Depository Libraries

Descriptions are given of a high-sensitivity method for determining the concentration and spatial distribution of thorium in minerals and rocks. A detector was used for recording (n-f) reactions on thermal and fast neutron tracks produced by thorium fission fragments. Uranium and thorium targets with ^{235}U, ^{238}U, and ^{232}Th were used in the experiment. In specially prepared specimens with thorium - uranium ratio of 1:3 and over and neutron flux 10^{16} n/cm^2 the method sensitivity is equal to 10^{-9} g/g. NSA

N69-40206 Purdue Univ., Lafayette, Ind.
AN INVESTIGATION OF SHALLOW DONOR IMPURITIES IN SILICON BY ENDOR
Edward Boyd Hale (Ph.D. Thesis) 1968 315 p
Avail: Univ. Microfilms: HC $14.20/Microfilm $4.05 Order No. 69-2882

Electron nuclear double resonance (ENDOR) was used to measure approximately twenty hyperfine tensors or shell patterns for each of the three donor impurities, arsenic, phosphorus, and antimony, in silicon. Thus the wave function density at approximately two hundred different lattice sites neighboring the donor were determined along with the various dipole matrix elements about the above sites. To assist in assigning the shells a theory was developed to predict the dipolar interactions at the various sites. This theory is formulated using the effective mass theory and the tetrahedral characteristics of certain orbitals which are then combined to form the electron wave function distribution in the lowest conduction band. The results of the calculations exhibit many of the basic features seen in the data. They predict reasonable agreement with several experimental values. Dissert. Abstr.

N69-40207 Missouri Univ., Columbia.
HIGH ENERGY LARGE ANGLE PROTON-PHOTON SCATTERING
Roland Eugene Wilcox (Ph.D. Thesis) 1968 74 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-3293

A study was made of elastic proton-proton scattering at high energy and large momentum transfer. A model was used which decomposes a proton during collision in an incoherent combinatorial manner. The technique used is slightly different but equivalent to the method used by Huang in obtaining the final probabilities for the final states. The new procedure allows one to keep N or the energy to finite, but large values. The analysis is limited to spinless protons and to regions of high energy where there exists no discontinuity in the shape of the angular distribution. The results of the theoretical curves are in excellent agreement with the experimental results from the center of momentum angles of 65° to 90° and laboratory momentums of 14 Bev./c to 27 Bev./c. The quenching of large momentum transfers for final states which is observed experimentally is duplicated. Dissert. Abstr.

N69-40212# California Univ., Berkeley. Lawrence Radiation Lab.
TABLES OF STRUCTURE AMPLITUDES FOR (p, He 3) REACTIONS
Norman K. Glendenning Aug. 1968 104 p refs
(Contract W-7405-eng-48)
(UCRL-18269) Avail: CFSTI

Tables are given which provide the projected wave function for the center-of-mass motion of a neutron - proton pair in a nucleus which occupies the single particle states j and j' with spin J, when their relative motion corresponds to that characteristic of what it is in the helium nucleus. NSA

N69-40217# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
PLUTONIUM 236 TRACE DETERMINATION IN PLUTONIUM 238 BY α SPECTROMETRY [DOSAGE DE TRACES DE PLUTONIUM 236 DANS LE PLUTONIUM 238 PAR SPECTROMETRIE α]
Miguel Luis Aceña (Junta de Energia Nucl.), Raymond Pottier, and René Berger Jul. 1969 37 p refs In FRENCH; ENGLISH summary
(CEA-R-3773) Avail: CFSTI

Two methods are described in this report for the determination of plutonium 236 traces in plutonium 238 by α spectrometry using semi-conductor detectors. The first method involves a direct comparison of the areas under the peaks of the α spectra of plutonium 236 and plutonium 238. The electrolytic preparation of

the sources is carried out after preliminary purification of the plutonium. The second method makes it possible to determine the Pu 236/Pu 238 ratio by comparing the areas of the α peaks of uranium 232 abd and uranium 234, which are the decay products of the two plutonium isotopes respectively. The uranium in the sources also deposited by electrolysis, is separated from 1 mg of plutonium either by a trilaurylamine extraction, or by the use of ion-exchange resins. Results obtained with plutonium of two different origins are also discussed. Author (ESRO)

N69-40234# Rome Univ. (Italy). Inst. of Physics.
SU(3) × SU(3) BREAKING AND THE MESON SYSTEM
A. K. Mohanti 10 Jun. 1969 18 p refs *Its* Nota Interna 223
Avail: CFSTI

A chiral Lagrangian model of spin 0 and spin 1 mesons transforming linearly under SU(3) × SU(3) and broken in a way to preserve field-current identity, SU(3) invariance of Schwinger terms, and PCAC at SU(2) level is used to determine $Fk/F\pi f_+(0)$ with reasonable agreement with experiment. Author (ESRO)

N69-40263# Technische Hochschule Aachen (West Germany). Physikalisches Inst.
NEUTRAL KAONS AND CP
H. Faissner 1968 118 p refs
(PITHA-26) Avail: AEC Depository Libraries

A phenomenological study of neutral kaons and CP is presented. The topics discussed include neutral kaons in strong and weak interactions, quantum mechanics of free neutral kaons, the regeneration of neutral kaons in matter, the phenomenology of CP violation in neutral kaon decays, and possible sources of CP violation. NSA

N69-40265# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
ABUNDANCES OF LONG-LIVED DELAYED NEUTRON GROUPS (T SUB 1/2 GREATER THAN 1 MIN) IN THE FISSION OF U-235, U-238, AND PU-239 BY FISSION-SPECTRUM NEUTRONS
L. Tomlinson and M. H. Hurdus Apr. 1969 10 p refs
(AERE-M-2199) Avail: CFSTI: UK 1S,9D

Upper limits are estimated for these abundances. The estimates are based on experimental measurements made on the thermal neutron fission of ^{235}U. Author (NSA)

N69-40270# Commissariat à l'Energie Atomique, Limeil (France). Centre d'Etudes Nucléaires.
RECOIL SPECTRA PRODUCED BY 14.1 MeV NEUTRONS [SPECTRES DE RENVOI DES GAMMAS PRODUITS PAR DES NEUTRONS DE 14,1 MeV]
Geneviève Clayeux and Gérard Grenier Aug. 1969 35 p refs In FRENCH; ENGLISH summary
(CEA-R-3807) Avail: CFSTI

Recoil spectra produced by 14.1 MeV neutrons on the following substances have been studied: carbon, nitrogen, oxygen, aluminium, iron and lead. The detection is effected at 90° to the incident neutron direction using a Ge (Li) detector. Values of the differential cross-section at 90° for the most important gamma rays are expressed in mb/sr. Author (ESRO)

N69-40287# International Centre for Theoretical Physics, Trieste (Italy).
CURVATURE COLLINEATIONS FOR GRAVITATIONAL pp-WAVES
P. C. Aichelburg Aug. 1969 19 p refs Sponsored partly by Osterr. Forschungsrat
(IC/69/80) Avail: CFSTI

Vacuum fields which admit a covariant constant vector are investigated in order to find 'curvature collineations', i.e., $\mathcal{L}_{Rq^{[2]}i} = 0$. For all discussed types of pp-waves it is shown that proper curvature collineations exist and the explicit form of these transformations are given. Author (ESRO)

N69-40288# Aktiebolaget Atomenergi, Studsvik (Sweden).
NEUTRON ELASTIC SCATTERING CROSS SECTIONS EXPERIMENTAL DATA AND OPTICAL MODEL CROSS SECTION CALCULATIONS: A COMPILATION OF NEUTRON DATA FROM THE STUDSVIK NEUTRON PHYSICS LABORATORY
B. Holmqvist and T. Wiedling Jun. 1969 213 p refs
(AE-366) Avail: CFSTI

Neutron elastic scattering cross section measurements have been going on for a long period at the Studsvik Van de Graaff laboratory. The cross sections of a range of elements have been investigated in the energy interval 1.5 to 8 MeV. The experimental data have been compared with cross sections calculated with the optical model when using a local nuclear potential. Author (ESRO)

N69-40334*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
INTERACTION CROSS SECTIONS OF NUCLEONS WITH HELIUM [SECHENIYA VZAIMODEYSTVIYA NYKLONOV S GELIYEM]
V. S. Barashenkov et al. Washington NASA Oct. 1969 4 p refs Transl. into ENGLISH from Russian report JINR-P2-4333
(Contract NASw-1692)
(NASA-TT-F-12606; JINR-P2-4333) Avail: CFSTI CSCL 20H

A theoretical determination of the interaction cross sections between fast nucleons and $_2He^4$ is made. Author

N69-40347# Kernforschungszentrum, Karlsruhe (West Germany). Inst. Fuer Experimentelle Kernphysik.
SINGLET AND TRIPLET FINAL STATE INTERACTION BETWEEN NEUTRON AND PROTON IN THE 1 H(D,2P)N REACTION [SINGULETT- UND TRIPLETT-FINAL STATE INTERACTION ZWISCHEN NEUTRON UND PROTON IN DER REAKTION 1 H(D,2P)N]
H. Brueckmann, W. Gehrke, W. Kluge, H. Matthaey, L. Schaenzler et al. Nov. 1968 18 p refs In GERMAN; ENGLISH summary Presented at the Profess. Comm. on Nucl. Phys., Bad Neuenahr, West Germany, Apr. 1968
(KFK-892; Conf-680461-1) Avail: AEC Depository Libraries

The three-particle reaction $^1H(d,2p)n$ was studied with 51.5-MeV deuterons from the Karlsruhe isochronous cyclotron. The two outgoing protons were detected in coincidence at laboratory angles $\theta_3 = +40°$ and $\theta_4 = 26°$. At these angles the final-state interaction between the neutron and one proton strongly influences the distribution of coincidences within the available phase space. The singlet and triplet final-state interaction between the neutron and proton is taken into account in an effective-range approximation. Author (NSA)

N69-40355 Princeton Univ., N.J.
A SEARCH FOR THE C-VIOLATING MODE POSITRON-ELECTRON-NEUTRAL PION IN THE DECAY OF THE ETA MESON
Albert Richard Zacher (Ph.D. Thesis) 1968 130 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-2573

In a deuterium bubble chamber experiment, 550,000 pictures were examined for eta meson decays of the C-violating type $\eta \rightarrow e^+ + e^- + \pi^0$ and the Dalitz conversion type $\eta \rightarrow e^+ + e^- + \gamma$. Eta mesons were produced in the 15-inch fast-cycling bubble chamber by an 820 MeV/c π^+ beam, through the reaction $\pi^+ + d \rightarrow p + p + \eta$. Picture preselection by a counter array was used to reduce the number of pictures to be scanned. A tantalum

plate inside the bubble chamber converted gamma rays and helped identify electrons from the decays. For the Dalitz decay $\eta \rightarrow e^+ + e^- + \gamma$ we find that both the observed branching ratio: $\Gamma(\eta \rightarrow e^+ + e^- + \gamma)/\Gamma(\eta \rightarrow \gamma + \gamma) = (0.93 \pm 0.4) \times 10^{-2}$, and the observed distribution of the (e $^+$e $^-$) invariant mass are consistent with theoretical predictions. Dissert. Abstr.

N69-40449 Virginia Univ., Charlottesville.
ENERGY SPECTRUM OF CHARGED PARTICLES EMITTED FOLLOWING MUON CAPTURE IN Si 28
Edward Lloyd Wills (Ph.D. Thesis) 1968 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-18246

The energy spectrum and branching ratio for charged particles resulting after muon capture in Si^{28} were measured. The spectrum, attributed mainly to proton emission, exhibits a low-energy cutoff at 1.4 MeV and a maximum at about 1.5 MeV from which it decreases approximately exponentially with a decay constant of 4.6 MeV. A branching ratio of 0.15-0.02 charged particle per capture was determined. Dissert. Abstr.

N69-40451 Virginia Univ., Charlottesville.
PHOTOPROTON SPECTRA FROM Si 28 AT BREMSSTRAHLUNG ENERGIES 22.5, 30, 40, AND 50 MeV
Thomas Arlington White, Jr. (Ph.D. Thesis) 1968 69 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-18245

The energy distribution of protons from $Si^{28}(\gamma,p)Al^{27}$ reaction was obtained by using a lithium-drifted silicon detector as a target, which was irradiated by bremsstrahlung having maximum energies of 22.5, 30, 40, and 50 MeV. To make this experiment possible, the pile-up arising from the high gamma background was strongly reduced by lengthening the duration of a beam burst and also by using a 75-centimeter length of graphite along the path of the beam to filter out the intense low-energy part of the bremsstrahlung. The structural features of the photoproton spectrum from the 22.5-MeV data, which agree with others' works, can be identified with the strong levels below 22.5 MeV in Si^{28} which emit protons leaving the residual Al^{27} mostly in the ground state or the few excited states available below 4 MeV. The 30-MeV spectrum does not show any additional structure. Dissert Abstr.

N69-40464# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FIXATION OF RADIOACTIVE RESIDUES Quarterly Progress Report, Feb. - Apr. 1969
A. G. Blasewitz, ed. May 1969 39 p refs
(Contract AT(45-1)-1830)
(BNWL-1074) Avail: CFSTI

Approximately 4,000,000 Ci of radioactivity were successfully processed in two spray solidification runs. Spray Solidification Run SS-8 was made using a simulated Purex Waste 1 (PW-1) feed while SS-9 was made using a simulated Purex Waste 4m (PW-4m) feed. This was the first radioactive demonstration of the PW-4m flowsheet; a relatively clean waste with an exposure of 45,000 MWd/tonne at 30 MW/tonne. Spray solidifier performance during solidification of the PW-4m flowsheet was excellent. Simulated PW-4m spray feeds suitable for use in the WSEP were successfully tested in the development spray solidifier. Feed additives of iron, sodium, lithium, and phosphate produced melts giving a volume reduction of eight from solidifying PW-4m at an equivalent 378 liters/tonne. Ruthenium volatilization from low acid PW-4m feed was suppressed by adding solid $NaPO_3$ flux to calcine in the development melter. The resulting melt in laboratory tests, however, contained a nonmelting rare earth phase that could plug the melter drain valves. Author (NSA)

N69-40467# Naval Radiological Defense Lab., San Francisco, Calif.
MULTIPLE LINEAR REGRESSION ANALYSIS OF SCINTILLATION GAMMA-RAY SPECTRA: THEORETICAL AND PRACTICAL CONSIDERATIONS
David F. Covell, M. Brown, and Sachio Yamamoto 5 Jun. 1969 28 p refs
(AD-690798; NRDL-TR-69-55) Avail: CFSTI CSCL 18/4

Application of the method of multiple linear regression as a data-analysis technique for gamma-ray scintillation spectrometer data requires knowledge of (1) the response matrix of the spectrometer and (2) the covariance matrix of the unknown spectrum (or spectra). Neither matrix is known exactly. The response matrix can usually be determined with good precision and an estimate of the covariance matrix can usually be made. Perturbations or errors in either matrix, however, will introduce biases in the results. In addition, in the formulation of the method, assumptions are made and criteria are specified which may be appropriate for particular applications. Once generated, the particular formulation is frequently assumed to be generally applicable; additional biases can thereby be introduced. In the report, theoretical and practical considerations are delineated which are important to the satisfactory utilization of the multiple linear regression method. Subjective judgments which are introduced in the formulation of the method are indicated, and in view of these judgments, specific areas are described where care must be exercised, both in the acquisition of the data and in the subsequent processing. Author (TAB)

N69-40502 Purdue Univ., Lafayette, Ind.
THE CHEMICAL EQUILIBRIA OF FISSION PRODUCT NUCLEAR FUEL MIXTURES: THE URANIUM-OXYGEN AND THE URANIUM-OXYGEN-STRONTIUM SYSTEM
Mario Herbert Fontana (Ph.D. Thesis) 1968 292 p
Avail: Univ. Microfilms: HC $13.30/Microfilm $3.75 Order No. 69-2918

Computation of chemical equilibria in the gas phase around a melted fuel element is difficult because the fuel may act as a solvent for the fission product. Methods of using multi-component chemical equilibrium computer techniques were developed for treating this problem, and they were tested against published Knudsen cell-mass spectrometer data for the U-O system. It was found that for the U-O systems, the gas phase composition could be predicted as a function of the O/U ratio in the solid phase, given the equilibrium constants of formation of the compounds of interest and the experimentally determined total pressure and atom ratios in the gas phase. The U-Sr-O system was estimated by relating the chemical species in the gas phase to a computed equilibrium composition of the same species in the condensed phase. The effect of excess oxygen pressure, variation in activity coefficients, variability in the thermodynamic properties and changes in O/U (solid) ratios were investigated. Dissert. Abstr.

N69-40506 Virginia Polytechnic Inst., Blacksburg.
NEUTRON TRANSPORT THEORY WITH A COMPLETELY DEGENERATE ENERGY TRANSFER KERNEL
James Fred Watts (Ph.D. Thesis) 1968 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-3042

An analytic solution of the time-dependent neutron transport equation in slab geometry is found for a completely degenerate energy transfer kernel and a $\frac{1}{v}$ total cross section. The time dependence is removed from the transport equation by a Laplace transformation and the solution of the homogeneous form of the transformed equation is expanded using the singular eigenfunction expansion method of Case. A superposition of the elementary solutions of the homogeneous transformed equation are used to construct a solution of the inhomogeneous equation with the expansion coefficients determined by the boundary conditions. The time dependence is recovered by the inverse Laplace transform

where the path of integration is deformed to the left as far as possible. To demonstrate the method of solution, three problems are outlined: an albedo problem, a two adjacent half-space problem, and an initial value problem. An exact eigenvalue condition is derived in the solution of the initial value problem and the eigenvalues are calculated. Dissert. Abstr.

N69-40514# International Centre for Theoretical Physics, Trieste (Italy).

A COVARIANT VERTEX FOR NON-RELATIVISTIC BOUND STATES

G. Bisiacchi (Trieste Univ.), P. Budini, and G. Calucci (Trieste Univ.) Jul. 1969 15 p refs Submitted for publication

(IC-69-72) Avail: CFSTI

The covariant description of the centre-of-mass motion for a composite system with non-relativistic internal motion is given, together with the vertex for its interaction with an external field. For low-momentum transfer an expression for the vertex in terms of three-dimensional wave functions, which includes relativistic effects, is deduced. At high-momentum transfer, retardation effects inside the composite structure must be taken into account. The algebrization of the equation for the free motion is given and that for the vertex discussed. Author (ESRO)

N69-40515# International Centre for Theoretical Physics, Trieste (Italy).

RADIATIVE CORRECTIONS TO WEAK DECAYS INVOLVING LEPTONS

Riazuddin Jul. 1969 51 p refs Presented at the Intern. Summer School on Weak Interactions, Karlsruhe, West Ger., Jul. 1969

(IC-69-85) Avail: CFSTI

The problem of radiative corrections to leptonic weak decays is discussed. The radiative corrections to the μ-decay and more generally to the case of the β-decay of a point-like particle of arbitrary charge are considered before the corrections to some semi-leptonic processes. The results are applied to the nuclear β-decay etc. ESRO

N69-40527 Michigan Univ., Ann Arbor.

COMPUTER SIMULATION OF SPACE-CHARGE FLOWS

Jack Edward Boers (Ph.D. Thesis) 1968 285 p

Avail: Univ. Microfilms: HC $12.85/Microfilm $3.70 Order No. 69-2286

Digital computer programs for the accurate determination of space-charge flows have been developed and are described for several types of electron gun configurations. The effects of space-charge and applied magnetic fields are taken into account and relativistic effects can be included. Direct particle-particle interaction effects are ignored, although dc thermal effects are given a brief treatment. The computer programs are written in the IBM-7090 FORTRAN programming language and require from four to 15 minutes to execute on an IBM 7000 digital computer. Individual sections of the programs, e.g., trajectory calculations, field evaluations, etc., are shown to be generally within 0.1 percent of theoretical predictions. The overall results are generally within four percent of either theory or experiment. Dissert. Abstr.

N69-40534# Naval Radiological Defense Lab., San Francisco, Calif.

MULTIPLE LINEAR REGRESSION ANALYSIS OF SCINTILLATION GAMMA RAY SPECTRA: AUTOMATIC CANDIDATE SELECTION

M. A. Hogan, S. Yamamoto, and D. F. Covell 17 Jan. 1969 28 p refs

(AD-691424; NRDL-TR-69-62) Avail: CFSTI CSCL 18/4

Multiple linear regression (MLR) has been shown to be a quantitative and statistically justifiable method for unfolding scintillation gamma-ray pulse-height spectra of radionuclide mixtures. The principal requirements of the method are: (1) that well-calibrated data be used, and (2) that the candidate set of spectra (standard spectra to be used as regression variables) must be complete and exclusive. In the usual application of the MLR method, the user exercises a great deal of subjective (irreproducible) judgement in the selection of a candidate set. Several algorithms have been proposed for automatic candidate selection but are not completely justifiable on the basis of proper statistical procedures. In this report, an algorithm is described in which justifiable statistical procedures are used. Correlation coefficients are examined to determine the proper candidate set for a given experimental spectrum. The inclusion or exclusion of candidate spectra are justified on the basis of valid statistical indicators, and an estimate of the goodness of the final fit is provided. The results of unfolding actual experimental spectra by this method are included in the paper. Author (TAB)

N69-40559# Aktiebolaget Atomenergi, Studsvik (Sweden). Neutron Physics Lab.

GAMMA RADIATION FROM FISSION FRAGMENTS. EXPERIMENTAL APPARATUS. MASS SPECTRUM RESOLUTION

Jack Higbie Aug. 1969 52 p refs

(AE-367) Avail: CFSTI

The gamma radiation from fission fragments was studied as a function of the fragment mass. The mass was determined from the fragment energies using solid state detectors. The mass resolution which can be achieved by this method is treated in detail. The average initial fragment mass and the initial mass resolution is calculated as a function of the measured (apparent) mass yield for three different thicknesses of the fissile material deposit. This treatment gives a clear indication of those factors most important for good mass resolution work. A detailed description of the experimental apparatus is given in the appendices. Author (ESRO)

N69-40578# Rome Univ. (Italy). Inst. of Physics.

MULTIPLE SCATTERING CORRECTIONS TO PION-PHOTOPRODUCTION

G. Benfatto, F. Nicolo, and G. C. Rossi 18 Jun. 1969 35 p refs *Its* Nota Interna 227

Avail: CFSTI

Following the idea of including in the scattering amplitudes absorbitive or multiple scattering corrections, a generalization of the Frautschi-Margolis model is proposed, in which, starting from Regge pole exchanges, one generates multiple scattering corrections in the form of Regge cuts. A detailed application of the model to the high energy π-photoproduction is exposed and numerical results are given both for polarized and unpolarized differential cross-sections, which are in agreement with experimental data. Author (ESRO)

N69-40595# Istituto Nazionale di Fisica Nucleare, Pisa (Italy).

PROGRESS ON THE 80-GeV PROTON SYNCHROTRON

26 Mar. 1968 357 p refs In ITALIAN

(NP-17846) Avail: AEC Depository Libraries

An analysis is presented of the technical, financial, and time obligations necessary for the development of an 80-GeV proton synchrotron in Italy. The general characteristics of the accelerator and the general structure of the complex are outlined. The principal synchrotron is described. A fast cycle injector synchrotron and an injector synchrotron with multiple rings are also considered. The general controls of the synchrotron complex are discussed. The most efficient methods of developing p-p and p-$\bar{p}$ crossed beam storage rings are discussed. A new method of coherent acceleration proposed by Veksler (Smokotron) is considered in some detail. The electron cooling method of damping the betatron and synchrotron oscillations is discussed. Author (NSA)

N69-40618# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.

STUDY OF EXCITED STATES OF THE Co 59 NUCLEUS BY MEASUREMENTS OF GAMMA-GAMMA ANGULAR CORRELATION AND LIFETIME [UNTERSUCHUNG ANGEREGTER ZUSTAENDE DES KERNS CO 59 DURCH GAMMA-GAMMA-WINKELKORRELATIONS UND LEBENSDAUERMESSUNGEN]

Ingo Arens (Ph.D. Thesis) [1969] 50 p refs In GERMAN
Avail: CFSTI

The E2/M1 multipole mixing ratio of 145, 191 and 336 keV gamma rays in Co 59, the g-factor of the 1288 keV level and the half life of the 1432 keV and 1288 keV levels of Co 59 were determined by measuring the excited and unexcited gamma-gamma angular correlation and retarded beta-gamma coincidence. To determine the g-factor of the 1288 keV level, the known hyperfine fields of Co (Fe) and Co (Ni) are used. The results are discussed within the framework of the weak coupling model of a single-hole(particle)-proton state with collective excitation of a Ni 60 (Fe 58) core. It is shown that only the low-lying state of Co 59 with particle-FE 58-core coupling can be approximately described. Adaption of wave functions to the resulting properties yields strong configuration mixing of various proton states with core-multiplet excitation. Transl. by R.B.

N69-40733# Army Nuclear Defense Lab., Edgewood Arsenal, Md.

A PROGRAM FOR THE OPTICAL ANALYSIS OF CHARGED PARTICLE BEAM TRANSPORT SYSTEMS

Michael W. Gilpatrick Jun. 1969 34 p refs
(AD-691328; NDL-TM-56) Avail: CFSTI CSCL 20/7

A FORTRAN IV code is described which allows the user to trace the trajectories of individual rays, comprising a charged particle beam, through a beam transport system. The characteristics of the transport system undergoing analysis are chosen by the user, via input data statements. Uniform field analyzing and switching magnets, as well as quadrupole lens pairs can be included within such a system. Program output consists of the off-axis displacements and slopes for both median and normal planes, time spreads relative to the ideal beam path, and a plot of the calculated trajectories. All calculations are carried out to first order, and applicable only to the non-relativistic case. The program source list is included. Author (TAB)

N69-40735# Eidgenoessiches Institut fuer Reaktörforschung, Wuerenlingen (Switzerland).

COLLISION PROBABILITY THEORY FOR CYLINDRICAL CELLS WITH CLUSTER ELEMENTS USING MULTIGROUP P SUB N THEORY IN THE MODERATOR ZONE

C. Maeder Feb. 1969 50 p refs
(EIR-147) Avail: AEC Depository Libraries

The use of collision probability theory for the calculation of neutron flux distributions in cylindrical lattice cells is described. The cylindrical cell consists of cluster regions surrounded by concentric annular zones. Anisotropic neutron scattering is considered; the finite height is accounted for by axial bucklings. A multipole expansion of the flux is used in the annular zones and, in the moderator, multigroup P_N expressions describe the flux. The multigroup integral transport equation is approximated by a system of linear equations for the spherical harmonics moments of the angular flux. Author (NSA)

N69-40750# Joint Inst. for Nuclear Research, Dubna (USSR). Lab of Theoretical Physics.

CLOSED UNIVERSE AND LAWS OF CONSERVATION OF ELECTRIC BARYON, AND LEPTON CHARGES

M. A. Markov 1969 31 p refs In RUSSIAN
(JINR-D2-4534) Avail: CFSTI

As is known the electrically charged matter excludes a closed metric of the world. The closed world should be electrically neutral. In modern theory baryon and lepton charges are treated as appropriate analogs of the electric charge. The question is discussed to what extent this analogy is conserved in the closed world. Some effects in the physics of assemblies of near-closed objects are considered. Author (NSA)

N69-40751# Edgerton, Germeshausen and Grier, Inc., Goleta, Calif.

USE OF 50-PICOSECOND LINAC BEAM FOR HIGH-RESOLUTION NEUTRON TIME OF FLIGHT MEASUREMENTS

R. B. Knowlen and A. A. O'Dell May 1969 26 p refs
(Contract AT(29-1)-1183)
(EGG-1183-2211; S-454-R) Avail: CFSTI

The 50-psec high-intensity (14 A, 20.5 MeV) beam from the EG&G/AEC electron linear accelerator was used with subnanosecond timing techniques to make high-resolution (80 psec/m) neutron time-of-flight measurements over a short (25.35 m) flight path. The fast-neutron transmission through a carbon absorber was measured by an NE-102 organic fluor scintillation detector, and the results were used to determine the total neutron cross section for carbon over the energy range of 2.05 to 3.4 MeV. Total cross-section values obtained show good agreement with those determined by others using longer flight paths. Apparatus and techniques used in this experiment are described in detail. Author (NSA)

N69-40773# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Laboratorio Tecnografico.

DIRECT POWER DETERMINATIONS OF URANIUM IN THE PRESENCE OF OTHER IONS [DETERMINAZIONE POTENZIOMETRICA DIRETTA DELL' URANIO IN PRESENZA DI ALTRI IONI]

V. Pompei, V. Altamura, and A. Canonico 3 Mar. 1969 35 p refs In ITALIAN
(RT/CHI(69)12) Avail: CFSTI

A method for the direct potentiometric analysis of uranium in solutions is discussed. This method of direct determination does not require extraction of the sample, and can be used on the cell to be analyzed. It reduces hexavalent uranium to tetravalent uranium by potentiometric titration with potassium bichromate. The chemical formulas are given. It is concluded that this method is simple, rapid, practical, and suitable for routine remote analysis. Tables comparing mg of uranium in solution with amounts of uranium dissolved using potentiometric titration are included. Transl. by F.O.S.

N69-40784 European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Div.

A SYSTEM APPROACH TO HIGH-SPEED COUNTER LOGIC

J. Dufournaud and B. Friend 6 Aug. 1969 27 p refs
(CERN-69-21) Avail: Issuing Activity

A system approach to high-speed counter logic and a practical realization for the study of the the $\Delta S/\Delta Q$ rule in kaon decays is described. Author

N69-40792# Naval Research Lab., Washington, D.C.

CONTROLLED THERMONUCLEAR REACTIONS: AN OCEAN OF ENERGY

R. Sagdeev 16 Jul. 1969 4 p Transl. into ENGLISH from Izv. (Moscow), v. 52, no. 3, Jan. 1969 p 1-4
(AD-691465; NRL-Trans-1175) Avail: CFSTI CSCL 18/1

The paper is a brief discussion of progress being made toward using thermonuclear power. TAB

N69-40820# Brown Univ., Providence, R.I. Dept. of Physics.
RESEARCH PROGRAM IN THEORETICAL HIGH-ENERGY PHYSICS Progress Report
David Feldman 1 Jun. 1969 8 p refs
(Contract AT(30-1)-2262)
(NYO-2262-TA-206) Avail: CFSTI

A summary of the progress made in theoretical high-energy physics during the year September 1, 1968, to August 31, 1969, is presented. The present status of the theoretical group is discussed, and a list of papers published during the year and papers in press is given. NSA

N69-40827# Atomic Weapons Research Establishment, Aldermaston (England).
MEASUREMENT OF (n, 2n) AND (n, 3n) CROSS SECTIONS AT 14 MeV INCIDENT ENERGY
D. S. Mather and L. F. Pain Aug. 1969 27 p refs
(AWRE-O-47/69) Copyright. Avail: HMSO: 4s

A large liquid scintillation counter has been used with a pulsed 14.1 MeV neutron source to measure (n,2n) and (n,3n) cross sections for H-3, He-3, Li-6, Li-7, B-10, B-11, Y, Cu, Pb and U-238. The measurements are based on the fission cross section of U-238 using a new method of flux measurement and $\bar{\nu}$ for Cf-252 spontaneous fission for the detector efficiency calibration. Author

N69-40830# California Univ., Berkeley. Lawrence Radiation Lab.
A POLARIZED ION SOURCE FOR THE BERKELEY 88-INCH CYCLOTRON
A. U. Luccio, D. J. Clark, D. Elo, P. Frazier, H. Meiner et al. Apr. 1969 24 p refs
(Contract W-7405-eng-48)
(UCRL-18607) Avail: CFSTI

A polarized proton and deuteron source for the Berkeley 88-inch cyclotron has been built and presently is being tested. The source, of the atomic beam type, is mounted vertically above the cyclotron, its beam being injected axially into the machine through a hole in the upper yoke. The axial injection system is described elsewhere. The source is of rather conventional design. Our main aim has been to use the best features of the most successful sources in operation in various laboratories, making improvements in design as far as possible. This provides a dependable system, flexible enough to leave room for future developments of the various parts. Author (NSA)

N69-40851# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
VECTOR MESON DOMINANCE AND DIFFRACTIVE ELECTROPRODUCTION OF VECTOR MESONS
H. Fraas and D. Schildknecht May 1969 33 p refs
(DESY-69/18) Avail: AEC Depository Libraries

A vector meson dominance model of diffractive electroproduction of vector mesons at high energies is presented. The assumption that the invariant amplitudes are slowly varying as a function of the vector meson mass, when extrapolating to the spacelike region, is shown to lead to serious difficulties when combined with helicity is shown to lead to serious difficulties when combined with helicity independence, i.e., equality of transverse and longitudinal on mass shell vector meson forward scattering helicity amplitudes at high energies. The assumption is adopted, therefore, that the helicity amplitudes are slowly varying, apart from the factors which guarantee the vanishing of the longitudinal amplitudes in the limit of zero mass. Assuming, in addition, helicity nonflip and helicity independence for vector meson scattering, expressions for the cross section for electroproduction of vector mesons and for the vector meson spin density matrix elements are derived. Also the conclusions on the total electroproduction cross section are presented. Author (NSA)

N69-40852# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
IDENTIFICATION OF THE RESONANCE PRODUCTION REACTIONS
G. I. Kopylov 1969 17 p refs In RUSSIAN
(JIRN-P1-4419) Avail: AEC Depository Libraries

A new functional to identify the reactions producing resonance is proposed. The usual functional (5) is criticized. It implies that the experimental errors ΔP_{ei} are small as compared to the width of the region on the energetical surface in which the density $M^2(P_0)$ of the true events varies sharply. The functional implies also that the errors are normally distributed; this is not valid for spherical momenta components (like θ, ϕ or tg α). The functional which takes into account the variation of density is (9). It is shown that the point R which minimizes the form (9) is nearer to true event Po than the point P which minimizes the form (5). But this estimate R of P^0 is biased ($R > P^0$). The identification of a reaction when the experimental error $\Delta_{P_{ei}}$ is comparable with the resonance width Γ_A is considered. In this case the minimization of the form, where $B_A(m_{23})$ is the Breit - Wigner function, will give the better estimates of events. The criterion of identification $\chi 2min \leq s$ (s-number of constraints), but this value s will be reached easier because of the extra term -1n Ba. The form discussed will facilitate the identification of dubious events, which equally satisfy both the hypotheses. Also the other forms of M2(P) are discussed: the Regge peaks or the experimental angular distributions. Author (NSA)

N69-40862# Scientific Translation Service, Ann Arbor, Mich.
INELASTIC INTERACTIONS OF HIGH-ENERGY DEUTERONS WITH ATOMIC NUCLEI
V. S. Barashenkov et al. [1969] 10 p refs Transl. into ENGLISH from the Russian. Prepared for Oak Ridge Natl. Lab.
(ORNL-TR-2164; JINR-P2-4346) Avail: CFSTI

A cascade-evaporation model of deuteron-nucleus interactions with the account of stripping processes was considered by the Monte Carlo method. In calculating the cascade the diffuseness of the nucleus boundary was taken into account and the energy momentum conservation laws were exactly fulfilled. Meson production processes were included into the theory and due to this fact one succeeded in advancing the energy region of >1 GeV. Good agreement with the whole amount of the available experimental data is pointed out. Author (NSA)

N69-40863# Osaka Univ. (Japan). Lab. of Nuclear Studies.
MAGNETIC MOMENTS AND BETA-DECAY ft VALUES OF MIRROR NUCLEI
Kenzo Sugimoto [1968] 12 p refs
(QU-LNS-69-4) Avail: AEC Depository Libraries

Under the assumption that the isospin is a good quantum number, the available data on the magnetic moments and the β-decay ft values for isospin doublets were analyzed. A systematic information concerning the distribution of angular momentum between the orbital and the spin and between the protons and the neutrons of a nucleus was obtained for the mirror nuclei. A favorable evidence for the mesonic exchange effect to the magnetic moment was found. Author (NSA)

N69-40888 Virginia Univ., Charlottesville.
SHELL MODEL CALCULATION OF ODD PARITY STATES IN THE A EQUALS 6 AND 14 SYSTEMS
Benjamin Stubbs Cooper (Ph.D. Thesis) 1968 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-18188

Odd parity excitations for the A = 6 and = 14 nuclei are calculated within the framework of the particle-hole shell model.

with a consistent treatment of core-excited configurations as well as excitations which affect only extra-core particles. Spurious states are removed, and a finite-range (gaussian) residual interaction with Wigner, Majorana, Heisenberg and Bartlett exchange components is diagonalized in the non-spurious subspace for all possible J and T values. A detailed comparison of the resulting distributions and the calculated level spectra with experimental data is made. In addition, normal parity results for the A = 6 and 14 systems and the A = 7 and 13 systems are presented. Dissert. Abstr.

N69-40889 California Univ., Riverside.
POMERANCHUK THEOREM FOR PARTIAL WAVES AND NARROWING OF RESONANCE WIDTHS: THE RHO MESON
David Tony Gregorich (Ph.D. Thesis) 1968 66 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-2655

A self-consistent calculation of the rho meson mass and width is done using the Frye-Warnock N/D formalism. The proposed model contains the assumption that low partial waves become purely imaginary at high energy. Application of a partial wave Pomeranchuk-type theorem then implies that the Frye-Warnock "Born" term must vanish asymptotically and that the integral equation for the real part of N is Fredholm. In all cases it is found that the experimental mass and width of the rho can be reproduced by suitable adjustment of the parameters s_A and η. Dissert. Abstr.

N69-40892 Miami Univ., Fla.
COVARIANT QUANTIZATION OF FIELDS
Roger F. Polcyn (Ph.D. Thesis) 1968 52 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-2680

A method of covariant quantization of fields satisfying the most general first order relativistic wave equation is developed. The method applies to fields of integral and half-integral spin. The consistency of free field quantization and the number and type of constraints which may be necessary are determined by the structure of the characteristic matrix operator. The connection between spin and statistics is also given in terms of this operator. Dissert. Abstr.

N69-40895# Sandia Corp., Albuquerque, N.Mex.
ELECTRICAL STUDIES OF LOW TEMPERATURE NEUTRON AND ELECTRON IRRADIATED EPITAXIAL N-TYPE GaAs
H. J. Stein [1969] 29 p refs Presented at Conf. on Nucl. and Space Radiation Effects, University Park, Pa. Sponsored by AEC
(SC-DC-69-1670; CONF-690704-5) Avail: CFSTI

Electron- and neutron-produced defects in epitaxially grown n-type GaAs were investigated, using Hall effect and electrical conductivity measurements. Electron irradiation at 80°K decreases both the carrier concentration and the mobility. Below room temperature annealing of electrically active defects is observed near 250°K in agreement with thermal conductivity and length-change measurements of electron-produced defect annealing. n-type bulk-grown GaAs. Neutron irradiation at 76°K also decreased both the carrier concentration and the mobility in n-type epitaxial GaAs. A light sensitivity of the carrier concentration and mobility is observed in GaAs after neutron irradiation. In contrast with electron-produced defects in GaAs, neutron-produced defects in the epitaxial layer exhibit only small and diffuse annealing throughout the 76 to 600°K temperature range investigated. The mobility degradation after 400°K annealing is measurement-temperature-dependent and decreases with increasing measurement temperature between 76 and 300°K. This carrier removal rate is in reasonable agreement with previous results. Author (NSA)

N69-40896# Sandia Corp., Albuquerque, N.Mex.
THERMAL AND INJECTION ANNEALING OF NEUTRON-IRRADIATED P-TYPE SILICON BETWEEN 76 DEG K AND 300 DEG K
C. E. Barnes [1969] 13 p refs Presented at Conf. on Nucl. and Space Radiation Effects, University Park, Pa. Sponsored by AEC
(SC-DC-69-1700; Conf-690704-1) Avail: CFSTI

Measurements of minority carrier lifetime damage constant and divacancy growth following neutron irradiation at 76°K were used to characterize further the annealing of neutron damage in silicon below 300°K. It was shown that electron injection into p-type silicon at 76°K causes recovery of the neutron induced defect clusters with the simultaneous appearance of divacancies. Isochronal annealing curves of damage constant taken with and without prior injection at 76°K illustrate the nature of cluster annealing below 300°K. The thermal annealing results are shown to agree with previous annealing measurements of the carrier removal rate. Author (NSA)

N69-40897# Sandia Corp., Albuquerque, N.Mex.
MINORITY CARRIER RECOMBINATION IN NEUTRON IRRADIATED SILICON
B. L. Gregory [1969] 42 p refs Presented at Conf. on Nucl. and Space Radiation Effects, University Park, Pa. Sponsored by AEC
(SC-DC-69-1703; Conf-690704-2) Avail: CFSTI

Measurements that provide extensive data on the resistivity, temperature, and injection level dependences f the minority carrier lifetime in neutron-irradiated p- and n-type silicon are reported. The lifetime damage constants are observed to be strongly dependent on the injected minority carrier density, in both conductivity types, over the temperature range from 76 to 300°K. The low-injection-level damage constants were measured and found to be strongly dependent on material resistivity in p-type silicon, but only slightly dependent on resistivity in n-type silicon. The results of the experimental studies are compared to the predictions of two alternate models for recombination at defect clusters. It is concluded from these comparisons that the defect clusters that dominate the minority carrier lifetime are approximately 250 Å in radius, and each contains a relatively small number of deep defects (30 to 40). The defects are individually characterized by a deep donor level near $E_v + 0.35$ eV and a deep acceptor level near $E_c - 0.50$ eV. NSA

N69-40913# Idaho Nuclear Corp., Idaho Falls. National Reactor Testing Station.
AN EVALUATION AND COMPILATION OF NEPTUNIUM 237 CROSS SECTION DATA FOR THE ENDF-B FILE
J. R. Smith and R. A. Grimesey May 1969 85 p refs
(Contract AT(10-1)-1230)
(IN-1182; ENDF-116) Avail: CFSTI

This evaluation of ^{237}Np neutron cross-section data was undertaken as part of the effort by the Cross Sections Evaluation Working Group (CSEWG) to assemble the first version of the Evaluated Nuclear Data File B (ENDF/B). Graphs of calculated and experimental data from which the various files for this isotope were constructed are included along with complete documentation over the energy range from 0.00001 eV to 15 MeV. Author (NSA)

N69-40914# California Univ., Livermore. Lawrence Radiation Lab.
INTERACTION OF INTENSE PHOTON AND ELECTRON BEAMS WITH PLASMAS
Ray E. Kidder 11 Apr. 1969 84 p refs Sponsored by AEC
(UCRL-71775) Avail: CFSTI

Some of the properties of focused laser beams such as the achievable electromagnetic energy density, electric and magnetic field intensity, and effective beam temperature are described to demonstrate the relevance of laser beams to the physics of high

energy density. Then the linear theory of the interaction of light beams with plasmas, together with some simple hydrodynamic consideration, is employed to derive scaling relations for the production of high temperature and high pressure plasma, to determine the pressure due to light-induced plasma blowoff, and to consider lightwave driven detonation waves. These more general topics are then followed by a specific consideration of the production and properties of tenth-microgram multi-kilovolt deuterium and mercury laser produced plasmas, including the results of detailed computer calculations. Next, some of the nonlinear effects that can occur in the interaction of very intense light beams with plasmas are considered. They are divided into two classes: single particle and collective nonlinear effects. Author (NSA)

N69-40915# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical.

MUON PAIR PRODUCTION IN STRONG INTERACTIONS AND THE ASYMPTOTIC SUM RULES

V. A. Matveev, R. M. Muradyan, and A. N. Tavkhelidze 1969 23 p refs

(JINR-P2-4543) Avail: AEC Depository Libraries

The process of muon pair production in the deep inelastic collision of two hadrons is considered. The sum rules were obtained combining the limiting values of form factors with the matrix elements of equal-time commutators of the electromagnetic currents. Author (NSA)

N69-40917# Atomic Energy Establishment, Winfrith (England). General Reactor Physics Div.

NUMERICAL STUDIES OF THE HYDROGEN EQUIVALENT OF SOME STRUCTURAL MATERIALS IN THEIR EFFECT ON U-238 RESONANCE CAPTURE

A. C. Aldous Mar. 1969 9 p refs

(AEEW-M-860) Avail: CFSTI ; UK 1s 9d

A set of values of λ, a parameter used by the resonance treatment in the WIMS lattice code to determine the hydrogen equivalent of a moderating material, is evaluated for some important reactor constituents. Energy-dependent values are tabulated for some moderating materials, and a graph is given showing effective one-group λ values plotted against atomic weight, so that one-group λ values for all nuclides can be deduced. The sensitivity of λ to the amount of moderating material present in the system is also tested. Author (NSA)

N69-40940# Brookhaven National Lab., Upton, N.Y.

REGGE BEHAVIOR AND MULTIPERIPHERAL PROCESSES

Francis E. Low (Mass. Inst. of Tech.) Jan. 1969 35 p refs Presented at Brookhaven Natl. Lab., Upton, N.Y., Jan. 1969 Sponsored by AEC

(BNL-50162) Avail: CFSTI

High-energy processes for which a Reggistic description may be given are considered. Regge poles, cuts, multi-Regge exchange, the Amati, Fubini, and Stanghellini technique and the multiperipheral Regge model are discussed. NSA

N69-40943# Maryland Univ., College Park. Dept. of Physics and Astronomy.

A PROGRAM TO CALCULATE PARTICLE SPECTRA PRODUCED IN HIGH ENERGY PROTON-PROTON COLLISIONS BY THE TWO-TEMPERATURE STATISTICAL MODEL

James R. Wayland and Martin La Pointe Apr. 1969 18 p Revised

(Contract F44620-69-C-0019)

(AD-691488; AFOSR-69-1927TR; TR-844) Avail: CFSTI CSCL 20/8

In the past few years, the lack of success of older statistical models led to new models that rely more on phenomenological observations. One of the most successful models in the two-temperature model of Wayland and Bowen. The analytic form of this model allows easy extension of the predictions to cosmic ray energies. A brief outline of the two-temperature model is presented. The application of the model is considered. TAB

N69-40960# Aktiebolaget Atomenergi, Stockholm (Sweden)

ACTIVATION DOPPLER MEASUREMENTS

I. Tiren [1968] 6 p refs

(NP-17908) Avail: AEC Depository Libraries

The accuracy attainable by using activation Doppler techniques in fast critical assemblies is discussed. The activation Doppler technique is outlined. Sources of both random and systematic error are analyzed. Interpretation of experimental data is discussed. NSA

N69-40961# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

NEW FINITE-ENERGY SUM RULES BASED ON THE MULTIPLE-SCATTERING MODEL FOR REGGE CUTS

F. Schremp Jun. 1969 14 p refs

(DESY-69/20) Avail: AEC Depository Libraries

New finite-energy sum rules (FESR) are proposed for the single-scattering term in Glauber's multiple-scattering formula. In the presence of the whole set of Regge cuts, arising from multiple scattering, there occur only Regge poles on the high-energy side of these FESR. A new interpretation of duality is given, and other possible applications of the FESR are discussed. Author (NSA)

N69-40962# Purdue Univ., Lafayette, Ind.

REVIEW OF EXPERIMENTAL METHODS OF ANALYSIS OF PION PION SCATTERING AND A UNIQUE SET OF DELTA SUB O SUP O

L. J. Gutay May 1969 48 p refs Presented at the Conf. on the Pion-Pion and Kaon-Pion Interactions, Argonne, Ill.

(Contract AT(11-1)-1428)

(COO-1428-126; CONF-690521-3) Avail: CFSTI

The theoretical concepts involved in the extraction of $\pi\pi$ scattering from the reaction $\pi + N \rightarrow N + \pi + \pi$ are discussed, and the analysis of a number of experiments which studied the $\pi\pi$ interaction at a dipion effective mass of less than one GeV is reviewed. The theoretical assumptions that these analyses have in common are emphasized, and it is shown that a unique set can be chosen. The $\pi\pi$ scattering on the mass shell, the relation between πN inelastic scattering and elastic $\pi\pi$ scattering, partial wave decomposition, and experimental methods for the determination of δ^0_0 and ambiguities in this determination are discussed. It is concluded that there is an S-wave $\pi\pi$ resonance with $\sqrt{s_0} \simeq 0.72$ GeV and $\Gamma \sim 140$ MeV. The factorization and extrapolation models give consistent answers. NSA

N69-40965 European Organization for Nuclear Research, Geneva (Switzerland). Data Handling Div.

ON THE QUALITY OF MEASUREMENTS MADE WITH THE HPD MINIMUM GUIDANCE SYSTEM

S. N. Ganguli and P. Villemoes 7 Jul. 1969 21 p refs

(CERN-69-18) Avail: Issuing Activity

The HPD-minimum guidance (MING) chain processed 5211 events with four- and six-prongs. First pass success rates of the events after the kinematical fitting program GRIND were 65% and 50% for the four-prongs and six-prongs, respectively. Results from these events were compared with an equal number of events (from the same exposure) measured on IEP. The following two conclusions are drawn on the quality of measurements by MING: (1) the comparison of track parameters and events showed that the measurements by MING are more precise than the IEP ones; and (2) the quality of physics results from the plots of missing-mass-squared distribution and the effective mass distribution

of $\pi^+\pi^-\pi^0$ seems to be better in the MING system than in the IEP one. The following two conclusions are drawn on the shortcomings of MING: (1) the fraction of failed events from the first pass is relatively large, namely 35% and 50% for the four- and six-prongs, respectively; and (2) among the GRIND-accepted events, the contamination due to the acceptance of wrong tracks was 4.3%. However, most of this contamination can be removed by making the geometry program THRESH more critical when reconstructing vertices; this improvement has now been implemented in THRESH. Author

N69-40970# California Univ., Berkeley. Lawrence Radiation Lab.
POSITIVE AND NEGATIVE PION - ALPHA SCATTERING AND THE PION FORM FACTOR
Anthony Fainberg (Ph.D. Thesis) 2 Apr. 1969 69 p refs
(Contract W-7405-eng-48)
(UCRL-19208) Avail: CFSTI

A measurement of the $\pi^{\pm}$-^{4}He scattering was made at 53, 60, 68, and 75 MeV incident pion lab energy. The resulting differential cross sections are presented. An attempt was made to extract the pion electromagnetic form factor using the difference in the $\pi+$ and π^- cross sections which is sensitive to the Coulomb contribution to the total scattering amplitude. An optical model potential was postulated for the nuclear part of the interaction. Various methods were used to extract the form factor, with a view to minimizing model dependence. The most detailed model available, using a method of analysis designed to reduce this dependence gives R = 2.96 ± 0.43F. Possible uncertainities in the model and its application are also discussed. Author (NSA)

N69-40979*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERACTION OF 42-MeV ALPHA PARTICLES WITH HELIUM-3
John S. Vincent and Edmund T. Boschitz Washington Nov. 1969 20 p refs
(NASA-TN-D-5530) Avail: CFSTI CSCL 20H

The center-of-mass differential cross section for the elastic scattering of 42-MeV alpha particles from ^{3}He was measured between 20° and 160°. Nonelastic events were integrated to estimate the total reaction cross section. Differential cross sections for ^{3}He(α,p)^6 Li to the ground and first excited states were measured between 20° and 160°. An optical model description of the elastic data gives a satisfactory description if the absorptive potential is radially extended beyond the real potential. The reaction cross sections are qualitatively described by the distorted-wave Born approximation theory. Author

N69-40990# Gosudarstvennpi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.
NONLOCAL INTERACTIONS IN EQUATIONS FOR AN EFFECTIVE FIELD: ISOTOPIC DISPLACEMENT [NELOKLNOST' VZAIMODEISTVIYA V URAVNENII DLVA EFFEKTIVNOGO POLYA: IZOTOPICHESKOE MESHCHENIE]
E. E. Sapershtein and V. A. Khodel 1967 11 p In RUSSIAN
(IAE-1426) Avail: AEC Depository Libraries

An investitation is made of the behavior of the Fermi system in an external field when the interaction forces between quasi-particles are not pointlike, i.e., the non-zero harmonics of the decomposition of the interaction amplitude of quasiparticles in accordance with the Legendre polynomials are not small. Author (NSA)

N69-41002# Addis Translations International, Woodside, Calif.
ACCELERATION OF MULTIPLE CHARGED IONS BY THE COLLECTIVE METHOD
M. L. Ionovich et al. Berkeley, Calif. Lawrence Radiation Lab., May 1969 11 p refs In ENGLISH and RUSSIAN Transl. into ENGLISH from Russian Report No. JINR-P9-4257 Sponsored by AEC Prepared for Calif. Univ., Berkeley. Lawrence Radiation Lab.
(UCRL-TRANS-1395; JINR-P9-4257) Avail: CFSTI

It is shown that collective methods of acceleration can be used to develop a compact accelerator of multiple-charged ions which will produce adequate intensity and energy for nuclear physics experiments. NSA

N69-41020# Purdue Univ., Lafayette, Ind. Chemistry Dept.
ANALYSIS OF THICK TARGET RECOIL STUDIES OF HIGH ENERGY NUCLEAR REACTIONS
N. T. Porile 28 Apr. 1969 27 p refs
(Contract AT(11-1)-1505)
(COO-1505-32) Avail: CFSTI

The effect of broad velocity distributions on the vector model analysis of average projected ranges obtained in thick-target experiments was explored. The Monte Carlo technique was used to construct velocity distributions on the basis of impact and breakup velocity distributions inferred from differential recoil studies. A range–velocity relation for fission products in uranium was constructed and tested. Calculations were performed for ^{131}Ba, ^{99}Mo, and ^{103}Pd formed in the interaction of uranium with 2.2-GeV protons. NSA

N69-41022# California Univ., Berkeley. Lawrence Radiation Lab.
BEVATRON OPERATION AND DEVELOPMENT Technical Report, Jul. – Sep. 1968
Kenneth C. Crebbin and Robert Frias 17 Jan. 1969 17 p ref
(Contract W-7405-eng-48)
(UCRL-18864) Avail: CFSTI

The Bevatron was on for experimenters 84% of the scheduled operating time, and a total of 1.9×10^{18} protons was accelerated this quarter. A total of 14 experiments operated; two experiments were completed. A new technique of flattopping the Bevatron magnet was tested and placed in operation. This new technique has provided a desired reduction incyclic stress on the motor generator sets and has provided flattops of up to 1 second duration at 5.3 GeV and 2.5 seconds at 3.7 GeV. Author (NSA)

N69-41026 Dow Chemical Co., Golden, Colo. Rocky Flats Div.
COMPUTER PROGRAM FOR DETERMINING THE GROWTH OF NUCLIDES FROM RADIOACTIVE DECAY
Charles R. Forrey, Jr. 25 Mar. 1969 54 p refs
(Contract AT(29-1)-1106)
(RFP-1098) Avail: CFSTI

A computer program was written for extrapolating the quantities of nuclides that are or will be presented in radioactive material previously analyzed for isotopic content by radiochemical methods. The modified Isogen (Isotope Generation) program can be used to determine the change in isotopic concentration of an element and hence, to determine the specific activity over extended periods of time. It can also be used to determine procedures necessary to analyze for any particular element and to determine if nuclides or elements are present in detectable quantities. It can also predict the isotopic concentration and impurity content of the final product at any given time in the future. Author (NSA)

N69-41029# Hawaii Univ., Honolulu.
EFFECT OF BACKGROUND ON THE I EQUALS 2 PION PION SCATTERING PHASE SHIFTS
V. J. Stenger 28 May 1969 30 p refs Presented at the Conf. on the Pion Pion and Kaon Pion Interactions, Argonne Natl. Lab., Ill., 14-16 May 1969
(Contract AT(04-3)-511)
(UH-511-49-69; CONF-690521-2) Avail: CFSTI

Aspects of a model, in which pion-exchange and rho-exchange processes add incoherently, for the reaction $\pi^+ + p \rightarrow \pi^+ + \pi^+$

$+ \pi^+ + p$ at 3.9 GeV/c are discussed relevant to the $\pi\pi$ phase shift analysis. It is concluded that the background from other processes, in particular, other important pion-exchange processes, produces the major portion of the forward peaking effect. Author (NSA)

N69-41030# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

MESON-NUCLEON CASCADE INTERACTIONS WITH EMULSION IN THE ENERGY RANGE 50 TO 80 GEV

I. Z. Artykov and V. S. Barashenkov 1969 8 p refs In RUSSIAN
(JINR-P2-4510) Avail: AEC Depository Libraries

Average characteristics, calculated within the intranuclear cascade model, are presented for inelastic interactions of nucleons and pions with different groups of the photoemulsion nuclei at energies 50 to 80 GeV. In calculating, multiple interactions inside the nucleus were taken into account. Author (NSA)

N69-41033# Technische Hochschule Aachen (West Germany). Physikalisches Institut (III).

DEPENDENCE OF NEUTRINO CROSS SECTIONS ON THE ATOMIC WEIGHT OF THE TARGET

M. Holder [1969] 8 p refs
(PITHA-29) Avail: AEC Depository Libraries

A comparison of the total neutrino rates in lead and aluminum respectively observed during a spark chamber neutrino experiment is reported. The results show no measurable deviation from the simple A law. Author (NSA)

N69-41034# Purdue Univ., Lafayette, Ind. Chemistry Dept.

CHARGE DISTRIBUTION AND RECOIL PROPERTIES IN THE FISSON OF U238

N. T. Porile and J. A. Panontin 29 May 1969 38 p refs
(Contract AT(11-1)-1505)
(COO-1505-34) Avail: CFSTI

Cross sections and thick-target recoil properties were determined for a number of products in the mass region 100 to 115 from the interaction of ^{238}U with 11.5-GeV protons. The recoil ranges of the neutron-deficient products are nearly a factor of two smaller than those of the neutron-excessive products, suggesting a difference in reaction mechanisms. On the basis of this finding a charge dispersion curve consisting of two separate gaussians, peaking at $N/Z = 1.22$ and 1.40 was constructed to fit the measured cross sections. The curve associated with the neutron-excessive products is very similar to that obtained in the fission of ^{238}U by 450-MeV protons except for a reduction in the fission cross section by a factor of 2.4. The values of the average deposition energy, average total kinetic energy of the primary fragments, and average separation distance at scission obtained for these fragments from their recoil properties are nearly equal to the corresponding values at 450 MeV. Author (NSA)

N69-41035# European Organization for Nuclear Research, Geneva (Switzerland).

METHOD OF SOLUTION OF THE WAVE EQUATION BY ADDITIVE POTENTIAL [METHODE DE SOLUTION DE L'EQUATION D'ONDE: A POTENTIEL ADDITIF]

A. N. Rezanov Oct. 1968 5 p Transl. into FRENCH from Russian Report In FRENCH
(CERN-Trans-68-11) Avail: AEC Depository Libraries

An additive potential method is proposed for the solution of the wave equation which allows an expression for E and ψ to be formulated without recourse to hypotheses having a model character on the properties of the U_1 and U_2 potentials. The method proposed can be easily generalized for application to the case of many particles or of many partial potentials. NSA

N69-41037*# GCA Technology Div., GCA Corp., Bedford, Mass.

A CONVERSION TABLE FOR WAVELENGTHS TO ELECTRON VOLTS AND 1/cm Interim Technical Report

James A. R. Samsov Jan. 1969 283 p refs
(Contract NASw-1726)
(NASA-CR-106406; GCA-TR-69-2-N) Avail: CFSTI CSCL 20H

This conversion table expresses energy in terms of wavelength (Å), wavenumbers (cm^{-1}), and electron volts (eV) over the range normally encountered in the vacuum ultraviolet. The wavelength range tabulated is from 100 to 2000Å. The range 100 to 1000Å is tabulated in increments of 0.1Å and from 1000 to 2000Å in increments of 0.2Å. By dividing the entries from 100 to 2000Å by ten, the table is extended to 20,000Å. Similarly, by multiplying the entries from 100 to 1000Å by ten, the short wavelength region is extended down to 10Å. This process can be continued by dividing or multiplying the entries by 100, 1000, etc. Thus, the table covers all wavelengths. Author

N69-41043# Atomic Energy Commission, New York. Health and Safety Lab.

LOW-ENERGY ATMOSPHERIC GAMMA RADIATION AS A MEASURE OF COSMIC-RAY SECONDARY ELECTRON FLUX

Wayne M. Lowder Jun. 1969 35 p refs
(HASL-209) Avail: CFSTI

The method described for determining the secondary electron flux from low-energy gamma-ray measurements will be useful in investigations of the properties of the cosmic radiation field within the atmosphere. A quantitative relation between the omnidirectional positron (and total electron flux) and 0.51-MeV annihilation photon flux is derived, applicable to atmospheric depths $>50\ g/cm^2$. This relation can be used to calibrate any experimental measure of low-energy photons, produced primarily by electron bremsstrahlung, in terms of total electron flux. Gamma-ray data from two balloon flights were used to determine an absolute electron flux profile throughout the atmosphere that is consistent with existing experimental data. Author (NSA)

N69-41045# State Univ. of New York, Stony Brook. Dept. of Physics.

RESEARCH IN THEORETICAL NUCLEAR PHYSICS Progress Report

Gerald E. Brown and Arnold M. Feingold Apr. 1969 61 p refs
(Contract AT(30-1)-4032)
(NYO-4032-3) Avail: CFSTI

Progress is reported and a program is proposed for research spanning a wide range of problems of current interest in nuclear theory; from the origin of the two-body force in meson theory and the translation of this force into an effective one in nuclear matter and nuclei by the use of many body techniques to the interpretation of nuclear structure with the use of models. Author

N69-41050# Wisconsin Univ., Madison.

ANGULAR DISTRIBUTION OF 24-MfV NEUTRONS SCATTERED BY PROTONS

L. N. Rothenberg 16 Jun. 1969 3 p Held at The Intern. Conf. on Properties of Nucl. States, Montreal, Canada
(Contract AT(11-1)-GEN-7)
(COO-7-506; CONF-690804-1) Avail: CFSTI

A counter telescope was used to detect recoil proton spectra from n + p elastic scattering at an incident neutron energy of 24.0 MeV. The differential cross sections were obtained from the normalization of the cm relative angular distribution to a total cross section of 397.2 mb measured previously. Author (NSA)
Pennsylvania Univ., Philadelphia.

N69-41051# Pennsylvania Univ., Philadelphia.

DETERMINATION RF DELTA SUB O SUP O AND DELTA

SUB 1 SUP 1 FROM CHEW-LOW EXTRAPOLATION
H. Hagopian, E. Bogart, S. Ma May 1969 30 p refs Presented at the Conf. on the Pion-Pion and Kaon-Pion Interactions, Argonne, Illinois, 14-16 May 1969
(Contract AT(30-1)-2171)
(NYO-2171-271; CONF-690521-1) Avail: CFSTI

Details of the Chew–Low extrapolation for a determination of δ^0_0 and δ^1_1 from the interactions $\pi^- + p \rightarrow \pi^- + \pi^+ (\pi^0) + n(p)$ are presented. The $\pi\pi$ mass plots, the ρ density matrix elements, a brief descriptirn of the Chew – Low extrapolation formalism, the four-momentum distribution if OPE were exact in the physical region, the various extrapolations for resonances, and the $\pi^{\pm,0}$mass spectra are covered. Author (NSA)

N69-41052# Brown Univ., Providence, R.I. Physics Dept.
THE RESEARCH PROGRAM IN EXPERIMENTAL HIGH ENERGY PHYSICS Progress Report, 1 Sep.1968 – 31 Aug. 1969
Anatole M. Shapiro Jun. 1969 13 p refs
(Contract AT(30-1)-2262)
(NYO-2262TB-145) Avail: CFSTI

A summary of the progress made in experimental high-energy physics during the year September 1, 1968, to August 31, 1969, is presented. Data analysis in progress and experimental runs in progress and in preparation are discussed, and a list of papers published during the year and papers in press is given. Author (NSA)

N69-41057# Joint Inst. for Nuclear Research, Dubna (USSR). Lab of Nuclear Reactions.
GAS-FILLED MASS-SEPARATOR FOR INVESTIGATION OF THE HEAVY ION REACTION PRODUCTS
I. Bacho, D. D. Bogdanov, Sh. Darotsi, V. A. Karnaukhov, L. A. Petrov et al. 1969 27 p refs In RUSSIAN; ENGLISH summary
(JINR-P13-4453) Avail: AEC Depository Libraries

A gas-filled mass separator for the investigation of short-lived products of nuclear reactions induced by heavy ions is described. For ^{103}Ag recoils in the case of helium filling, the resolution is obtained to be ≈3%(on $H\rho$),15 to 20% of recoils escaping the target reach the focal plane. The separator parameters with air filling are investigated as well. The $H\rho$ values for recoils are investigated in the mass range from 84 to 149. Anomalous decrease of the equilibrium charge in the transition to the rare-earth elements is observed; for dysprosium it is equal to 15%. Apparently, the filling of the inner 4f-electron shell leads to decrease of the electron cross section. Author (NSA)

N69-41058# Joint Inst. for Nuclear Research, Dubna (USSR). Lab of Nuclear Problems.
TAKING ACCOUNT OF PARTICLES LEAVING A DETECTOR DUE TO SCATTERING
A. V. Burduli, D. D. Dzhalaganiya, N. I. Kostanashvili, G. I. Lebedevich, D. S. Nabichvrishvili et al. 1969 11 p refs In RUSSIAN; ENGLISH summary
(JINR-P1-4490) Avail: AEC Depository Libraries

The parameters characterizing the scattering of pion-mesons with the energies up to 80 MeV in photoemulsion were investigated experimentally. The method of determination of corrections to the particles leaving the detecting system due to scattering was considered. This method can be applied also in the case of large ionization losses. Author (NSA)

N69-41081# Gulf General Atomic, San Diego, Calif.
PLASMA TRANSPORT AND FLUCTUATIONS IN A TOROIDAL QUADRUPOLE
Masaji Yoshikawa and Tihiro Ohkawa 31 Jan. 1969 12 p refs Presented at 9th Intern. Conf. on Phenomena in Ionized Gases, Bucharest, 31 Aug – 6 Sep. 1969
(Contract AT(04-3)-167)
(GA-9226) Avail: CFSTI

The plasma transport rate in the toroidal quadrupole at Gulf General Atomic is calculated from the properties of fluctuations. The transport rate is compared with the density decay time. The fluctuation-induced diffusion is consistent with the observed decay time, except near the separatrix. Within an ion orbit of the separatrix additional transport processes are required to account for the observed decay time. Author (NSA)

N69-41092# Japan Atomic Energy Research Inst., Tokyo.
COLLECTED PAPERS ON DISINTEGRATION STUDIES OF SHORT-LIVED NUCLIDES
Tomitaro Ishimori and Kaoru Ueno, eds. Jul. 1969 34 p
(JAERI-1178) Avail: CFSTI

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1. HALF-LIVES OF CALCIUM-49 AND SCANDIUM-49 M. Saeki, K. Ueno, and T. Ishimori p 2 – 4 refs (See N69-41093 24-24)

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3. THE DISINTEGRATION OF YTTRIUM-89M K. Ueno, M. Hoshi, M. Saeki, T. Kon, and T. Ishimori p 9 – 11 refs (See N69-41095 24-24)

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7. THE DISINTEGRATION OF BARIUM-137M K. Kimura p 23 – 24 (See N69-41099 24-24)

8. HALF-LIFE OF PROTACTINIUM-234M M. Saeki, K. Kimura, and T. Ishimori p 25 – 28 refs (See N69-41100 24-24)

N69-41093# Japan Atomic Energy Research Inst., Tokyo.
HALF-LIVES OF CALCIUM-49 AND SCANDIUM-49
M. Saeki, K. Ueno, and T. Ishimori *In its* Collected Papers on Disintegration STudies of Short-Lived Nuclides Jul. 1969 p 2 – 4 refs (See N69-41092 24-24)
Avail: CFSTI

The decay of radioactivity due to radiocalcium purified with precipitation was carefully measured with a scintillation counter in order to find accurate values of half-life for Ca-49 and its daugher, Sc-49. Author

N69-41094# Japan Atomic Energy Research Inst., Tokyo.
HALF-LIFE OF TITANIUM-51
T. Ishimori, K. Ueno, M. Hoshi, M. Saeki, and K. Awa *In its* Collected Papers on Disintegration Studies of Short Lived Nuclides Jul. 1969 p 5 – 8 refs (See N69-41092 24-24)
Avail: CFSTI

The half-life of Ti-51 after purification was determined with simple solvent extraction techniques. Half-life determinations were made on purified samples from different irradiations. The half-life values are summarized together with those from the literature. The weighted mean value 5.752 ± 0.007 minimum, is lower than values reported previously. Author

N69-41095# Japan Atomic Energy Research Inst., Tokyo.
THE DISINTEGRATION OF YTTRIUM-89M
K. Ueno, M. Hoshi, M. Saeki, T. Kon, and T. Ishimori *In its* Collected Papers on Disintegration Studies of Short-Lived Nuclides

Jul. 1969 p 9–11 refs (See N69-41092 24-24)
Avail: CFSTI

Yttrium-89m was stripped rapidly from tri-*n*-butyl phosphate solution of ^{89}Zr-^{89m}Y with 10N HCl, and half-life measurements were carried out. The half life values obtained and the standard deviation were smaller than those in the literature. Author

N69-41096# Japan Atomic Energy Research Inst., Tokyo.
HALF-LIFE OF NIOBIUM-92M
H. Sugiura, M. Saeki, and T. Ishimori *In its* Collected Papers on Disintegration Studies of Short-Lived Nuclides Jul. 1969 p 12–14 refs (See N69-41092 24-24)
Avail: CFSTI

Niobium-92m was prepared by ^{93}Nb (γ,n) reaction and identified with its γ-spectrum after being purified. The decay of the activity was followed very carefully for about 120 days. Using decay curves, the half-life of Nb-92m was determined. Short-lived isomers were not found. Author

N69-41097# Japan Atomic Energy Research Inst., Tokyo.
THE DISINTEGRATION OF NIOBIUM-97M AND 97G
F. Hagiya, K. Kimura, and T. Ishimori *In its* Collected Papers on Disintegration Studies of Short-Lived Nuclides Jul. 1969 p 15–20 refs (See N69-41092 24-24)
Avail: CFSTI

Carrier-free niobium separation was achieved with tributyl-phosphate as an extractant from HCl-HF mixture solution. Results obtained in a preliminary experiment indicate that, although *Kd* values for niobium and zirconium decrease by the addition of HF to HCl solution of the elements, only those for niobium show increasing *Kd* values with a further increase of HF concentration. Separation of niobium from zirconium was successfully demonstrated in the case of a Zr-Nb-95 pair and further applied to Zr-Nb-97 (m and g) mixtures. Half-life values for Nb-97g and Nb-97m are discussed. Author

N69-41098# Japan Atomic Energy Research Inst., Tokyo.
HALF-LIVES OF RHODIUM-106, -105, AND -103M
Y. Kobayashi *In its* Collected Papers on Disintegration Studies of Short-Lived Nuclides Jul. 1969 p 21–22 refs (See N69-41092 24-24)
Avail: CFSTI

Rhodium-106, -105 or -103m was identified by the measurement of γ-ray spectrum of the nuclide or its parents. Rhodium-105 was counted with a gas-flow proportional counter, and Rh-103m with a 0.1" × 1" NaI(Tl) scintillation counter. For Rh-106, a well-type NaI(Tl) scintillation counter with a 400 channel multiscaler was used. The scaler was set one channel per second. Analyses of the decay curves were carried out with an IBM computer. Values for the half-lives of Ru-106 and Ru-103 were assumed to be 1.00y and 40.0d, respectively. The values of the half-lives obtained are given along with the literature values. Author

N69-41099# Japan Atomic Energy Research Inst., Tokyo.
THE DISINTEGRATION OF BARIUM-137M
K. Kimura *In its* Collected Papers on Disintegration Studies of Short-Lived Nuclides Jul. 1969 p 23–24 (See N69-41092 24-24)
Avail: CFSTI

Carrier-free separation of Ba-137m from Cs-137 was carried out by using zirconium phosphate as the inorganic exchanger. Cesium was adsorbed on the phosphate column from 2N HNO_3 solution, whereas barium passed through. Experimental values of Ba-137m are given. Author

N69-41100# Japan Atomic Energy Research Inst., Tokyo.
HALF-LIFE OF PROTACTINIUM-234M
M. Saeki, K. Kimora, and T. Ishimori *In its* Collected Papers on Disintegration Studies of Short-Lived Nuclides Jul. 1969 p 25–28 refs (See N69-41092 24-24)
Avail: CFSTI

Four measurements of Pa-234m half life were carried out. Data were analyzed using the FRANTIC-7044 code. The values obtained are summarized together with those from the literature. Procedures for preparing Th-234 cow solution, milking Pa-234m, and identifying Pa-234m are discussed. Author

N69-41110# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
SLOW NEUTRON DETECTOR WITH THE POLYETHYLENE SPHERE MODERATOR USED IN NEUTRON DOSIMETRY
V. E. Aleinikov, V. A. Arkhipov, and M. M. Komochkov 1969 20 p refs In RUSSIAN
(JINR-P16-4480) Avail: AEC Depository Libraries

A device for measurement of a dose equivalent, absorbed dose, and neutron flux is described. The neutron detector uses the reaction $^{10}B(n,\alpha)^{7}Li$, which is recorded as scintillations of α-particles in ZnS(Ag). Author (NSA)

N69-41112# Mound Lab., Miamisburg, Ohio.
ENERGY LEVELS OF Na-21
F. X. Haas, Jr. 20 May 1969 151 p refs
(Contract AT-33-1-GEN-53)
(MLM-1644) Avail: CFSTI

The energy levels of ^{21}Na were studied through the $^{19}F(^{3}He,n\gamma)$, $^{20}Ne(p,\gamma)$, and $^{20}Ne(d,p)$ reactions. The n-γ coincidence spectra were measured for the $^{19}F(^{3}He,n\gamma)$ reaction at 2.5–MeV ^{3}He energies. Gamma spectra were measured for the $^{20}Ne(p,\gamma)$ reaction at proton energies of 1 to 2.2 MeV. Differential cross sections were measured for the $^{20}Ne(d,p)$ reaction at deuteron energies of 3.6 to 6 MeV. Spectroscopic factors and branching ratios were determined for transitions in sodium 21. NSA

N69-41113# Sandia Corp., Albuquerque, N.Mex.
ENERGY SCALING OF A PLASMA FOCUS DEVICE
F. L. Patterson Jun. 1969 23 p refs
(SC-RR-69-323) Avail: CFSTI

The neutron and x-ray radiation characteristics of a plasma-focus device were investigated as a function of source energy and deuterium filling pressure. Neutron production was found to scale approximately linearly with peak current, but x-ray yield was not dependent in a simple way upon current. A limiting value of peak dI/dt was encountered beyond which significant neutron and x-ray yield was not obtained. Author (NSA)

N69-41137# Oak Ridge National Lab., Tenn. Office of Language Services.
AUTOMATIC TRACING OF CONTOUR CURVES USING A (I,J) MATRIX OF STATISTICAL QUANTITIES
R. Kamoun, A. Faucon, and P. Gluzman 1968 21 p refs Transl. into ENGLISH from Nucl. Instr. Methods, no. 58, 1968 p 45–56 Sponsored by AEC
(ORNL-tr-2147) Avail: CFSTI

The use of a multiparameter system for the purpose of observing gamma-charged particle correlations has led to the representation of experimental results by contour curves. Starting with a smoothing operation this processing was found adequate for an A(I,J) matrix, where A is the number of nuclear events corresponding to two correlated parameters (e.g., energies), as in particle-gamma correlation experiments. NSA

N69-41166 European Organization for Nuclear Research, Geneva (Switzerland.) Rings Div.
TRANSVERSE OSCILLATIONS OF A RELATIVISTIC

PARTICLE BEAM IN A LAMINATED VACUUM CHAMBER
B. Zotter 9 Jun 1969 60 p refs Revised
(CERN-69-15-Rev) Copyright. Avail: Issuing Activity

Coherent transverse oscillations of relativistic particle beams may limit the number of particles that can be contained in accelerators and storage rings. In order to calculate the limit of stability, the electric and magnetic fields caused by the oscillating beam must be known. These fields exert an electromagnetic force on the beam particles, which may be expressed by the dispersion relation coefficients. The dispersion relation coefficients for vacuum chamger walls consisting of several layers of material are discussed, and a method is described which allows the calculation of these coefficients for a cylindrical beam surrounded by an arbitrary number of concentric layers. The dispersion relation coefficients are evaluated numerically, and analytic expressions are found in the long wavelength limit for not too complicated wall configurations. The results are presented in the form of graphs of the dispersion relation coefficients for typical intersecting storage ring parameters.
Author

N69-41182# Scientific Translation Service, Ann Arbor.
BUILDUP OF LOW-ENERGY RADIATION IN ACCELERATOR SHIELDS
B. S. Sychev [1969] 26 p refs Transl. into ENGLISH from Russian Report No. JINR-P16-4304 Sponsored by AEC Prepared for Oak Ridge Natl. Lab.
(ORNL-tr-2165; JINR-P16-4304) Avail: CFSTI

The buildup of low-energy radiation in a shield through which high-energy neutrons are propagated is examined on the basis of the theory of the compound nucleus and the evaporation model. By comparing the experimental and calculated results with respect to both the individual components of low energy radiation as well as the total dose, it is concluded that the method discussed is practically acceptable for calculating the shields of accelerators.
Author (NSA)

N69-41193# Addis Translations International, Woodside, Calif.
PMR SPECTRA OF RARE-EARTH COMPLEXES
P. L. Burkert, H. P. Fritz, W.Gretner, H. J. Keller, and K. W. Schwarzhans Aug. 1968 4 p refs Transl. into ENGLISH from Inorg. Nucl. Chem. Letters (London), v. 4, no. 31-2, 1968 4 p Prepared for Lawrence Radiation Lab.
(UCRL-10266) Avail: CFSTI

PMR spectra of some complexes of rare earths with ligands such as benzoylacetone and dibenzoylmethane were recorded. Shifts and line widths for the piperidinium salts of $[PrL_4]^-$ and $[DyL_4]^-$ are tabulated. It was concluded from studies on the compound [Pr benzoylacetone)$_4$] that the strong shift of the NH_2 protons of the piperidinium cation to higher fields is due to the dominance of a dipole-dipole interaction component in the shifts.
NSA

N69-41199# Japan Atomic Energy Research Inst., Tokyo. Div. of Health Physics and Safety.
CALCULATION OF PRIMARY ENERGY TRANSFER AND EFFECTIVE INACTIVATION CROSS SECTION OF BIOLOGICAL TARGETS FOR HEAVY CHARGED PARTICLES BASED ON MICRODOSE CONCEPT
Takao Numakunai, Satoru Ohtani, Katsuo Kawai, and Nobuo Oda (Tokyo Inst. of Tech.) Feb. 1969 28 p refs
(JAERI-1179) Avail: CFSTI

The distribution of primary energy transfer in a small track segment in water (based on the microdose concept) was calculated according to the newly developed method with an IBM-7044 computer for heavy charged particles, which have energies of 4 ≈ 12 MeV/amu and effective chages of 1 ≈ 18, and varying the cut-off energy of delta-ray (125, 250, 500 and 1000 eV) and the target size (l/W = 1/1000 ≈ 1/10 in unit of 100 Å/eV). The distributions of primary energy transfer for all of these cases are presented as the function of l/W. With the results obtained above, the ratio of the effective inactivation cross section to the geometrical cross section for the biological targets (S_{eff}/S_0) were calculated for heavy charged particles on the basis of *T*-distribution and one-target model.
Author

N69-41214# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ANGLE DISTRIBUTIONS AND POLARIZATIONS IN HIGH ENERGY PION-NUCLEON SCATTERING
O. A. Khrustalev, V. I. Savrin, and N. E. Tyurin 1969 34 p refs
(JINR-E2-4479) Avail: AEC Depository Libraries

On the basis of the Schroedinger equation expressions for the scattering amplitudes, differential cross sections and polarizations in the small and large angle elastic πN and charge-exchange scatterings are obtained.
Author (NSA)

N69-41215# Joint Inst. For Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
EXPERIMENTAL STUDY OF MANY-BODY REACTIONS WITH Li 8 PRODUCTION IN SLOW NEGATIVE PION CAPTURE BY C12, N14, R16 NUCLEI
N. M. Agababian, Yu. A. Batusov, S. A. Bunyatov, Ch. M. Chernev (Bulg. Acad. of Sci.), P. Cruer et al (Centre de Rech. Nucl.). 1969 22 p refs
(JINR-E1-4492) Avail: AEC Depository Libraries

Three-, four-, and five-body reactions leading to ^8Li production in negative pion capture by carbon, nitrogen, and oxygen nuclei were studied by using photoemulsion chambers. The relative probabilities of various reaction channels were determined. Measurements were made of the energy spectra and angular correlation of secondary particles for the reactions $\pi^- + {}^{12}C \rightarrow {}^8Li + {}^2H + {}^1H + n$, $\pi^- + {}^{14}N \rightarrow {}^8Li + {}^3He + {}^2H + n$, and $\pi^- + {}^{14}N \rightarrow {}^8Li + {}^4He + {}^1H + n$. The experiments show that four-nucleon clusters (^4Li) in the ^{12}C nucleus are of importance in the reactions with ^8Li production in slow negative pion capture.
Author (NSA)

N69-41216# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics
THE "SHELLS" IN NUCLEI WITH Z GREATER THAN 80. PART 1: SHELL CORRECTION
V. V. Pashkevich 1969 19 p refs In RUSSIAN
(JINR-P4-4383) Avail: AEC Depository Libraries

The shell correction was calculated for nuclei with Z > 80. The single-particle spectrum in the deformed potential with a diffuse edge was used.
Author (NSA)

N69-41218# Academy of Sciences (USSR), Moscow. Inst. of Physics.
COLLECTIVE METHODS OF ACCELERATION
M. S. Rabinrvich 1969 48 p refs In RUSSIAN Ser. *Its* Preprint No. 36
(NP-17918) Avail: AEC Depository Libraries

A general review is given on the aspects of the up-to-date collective methods of acceleration. Basic physical problems on collective methods of acceleration, electron rings, electron currents, plasma accelerators, the magneto-dissipative method of acceleration, the linear plasma beatron, and the radiative method of acceleration are discussed.
NSA

N69-41223# Comitato Nazionale per l'Energia Nucleare, Roma (Italy).
A COMPILATION OF NUCLEAR DATA ON THERMAL FISSION PRODUCTS OF U 233, U 235, AND Pu 239
G. Cenacchi 1968 80 p refs
(RT/FIMA-(68)4) Avail: AEC Depository Libraries

Tables are presented on fission-product decay chains, thermal neutron fission yields, nuclear data of fission products, and products of neutron capture by fission products. NSA

N69-41237# State Inst. for Technical Research, Helsinski (Finland).
THE CONDUCTION MECHANISM IN MONOCRYSTALLINE SELENIUM
J. Heleskivi, T. Salo, and T. Stubb 1969 15 p refs Presented at the 3d Nordic Solid State Conf., Copenhagen, 1968 Supported by the European Selenium-Tellurium Comm. /ts Julkaisu Publ-147
Avail: CFSTI

The barrier model for explaning the conductivity mechanism in trigonal selenium single crystals is presented. The model is applied to the results obtained from conductivity measurements and the Hall measurements. The lengths of the high resistivity barriers are estimated from the conductivity measurements. The barrier is not satisfactory at temperature 78°K and the conductivity vs. frequency is of the form $\sigma \approx f^{0.8}$. This indicates a hopping effect between impurities. From the Hall measurements an approximate mobility value, 260 cm^2/Vs, is obtained in the direction of the c-axis at room temperature. Author

N69-41243# Pennsylvania Univ., Philadelphia.
UNCONVENTIONAL MODELS OF WEAK INTERACTIONS
Gino Segre Jul. 1969 42 p refs Supported in part by AEC
(NYO-2171-277) Avail: CFSTI

Renormalizable and nonrenormalizable models of weak interactions are considered. This whole series of models discussed agrees with the simple phenomenological interaction but differ from it when calculations are performed to higher order in G_F when it becomes necessary to the behavior for all momentum transfers. NSA

N69-41246# Puerto Rico Nuclear Center, Mayaguez.
PUERTO RICO NUCLEAR CENTER ANNUAL REPORT, 1968
1968 178 p refs
(Contract AT(40-1)-1833)
(PRNC-131) Avail: CFSTI

Developments in training and research in the peaceful use of nuclear energy are summarized. Developments in nuclear science, nuclear engineering, physical sciences, clinical radioisotope applications, radiotherapy and cancer research, agricultural bio-sciences, medical sciences and radiobiology, research reactors, health physics, and radioecology are outlined. Also, papers, publications, and seminars are listed. NSA

N69-41249# European Organization for Nuclear Research, Geneva (Switzerland).
ANNUAL REPORT, 1968
1968 196 p refs
(NP-17947) Avail: AEC Depository Libraries

Research and development at the 28-GeV proton synchrotron are described including work on beam injection and fast extraction systems, bubble chambers, beam separators and transport systems, data processing systems, and other associated equipment. Progress on construction and development of the Intersecting Storage Rings is presented, and design studies for the 300-GeV proton synchrotron are briefly described. Also the research and development program at the 600-MeV proton synchrocyclotron is discussed. Nuclear and high-energy physics experimental programs are outlined. Administrative data on the finance division, personnel division, and technical services and buildings division are given. Author (NSA)

N69-41251# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
NEUTRON DOSIMETRY CALCULATIONS FOR MULTIPLE-CYCLE IRRADIATIONS FROM SEVERAL DOSIMETERS INCLUDING NICKEL-58
C. L. Hilf 6 Sep. 1968 13 p refs
(Contract AT(40-1)-2847)
(GEMP-699) Avail: CFSTI

Solutions to the dosimetry equations are presented for the thermal neutron (n,γ) reactions in ^{59}Co and ^{58}Fe, and the fast neutron (n,p) threshold reactions in ^{58}Ni, ^{54}Fe, and ^{46}Ti. The mathematical relationships take into account multiple-cycle irradiations and the burn-up of the product isotopes. No correction factor is necessary when using the ^{58}Ni dosimeter since the isomeric state, ^{58m}Co, is taken into consideration for all irradiation and decay times. Author (NSA)

N69-41253# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
RESPONSE OF SELECTED THERMOLUMINESCENT MATERIALS TO FAST-NEUTRON EXPOSURES
G. W. R. Endres and L. F. Kocher 5 Sep. 1968 13 p Presented at the 2nd Intern. Conf. on Luminesce Dosimetry, Gatlinburg, Tenn.
(Contract AT(45-1)-1830)
(BNWL-SA-1830) Avail: CFSTI

Studies to determine the optimum thermoluminescent material for personnel fast neutron dosimetry are described. Response curves for various thermoluminescent materials for monoenergetic neutrons from 0.02 to 5 MeV are presented. Thermoluminescent materials studied were lithium fluoride (TLD-100, -600, and -700), lithium tetraborate, calcium fluoride, and beryllium oxide. NSA

N69-41254# Gosudarstvennyi Komitet Po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.
CROSS-SECTION OF ELEMENTARY PROCESSES OCCURRING IN HYDROGEN PLASMA
V. M. Balebanov and V. S. Svishchev 1968 16 p refs In RUSSIAN
(IAE-1713) Avail: AEC Depository Libraries

A compilation of cross sections for the elementary processes transpiring in a hydrogen plasma is presented. The dependence of the cross section of each process on the energy of an incident particle in the range of energy values up to 30 keV was investigated. Only those interactions are considered with values in excess of 10^{-17} cm^2 (in the energy range noted) for the ionic - atomic collisions, and in excess of 10^{-18} cm^2 for the electron processes. NSA

N69-41255# Princeton Univ., N.J. Palmer Physical Lab.
THE LEVEL STRUCTURE OF Te-116, Te-118, Te-120, Te-122
E. H. Spejewski, P. K. Hopke, and F. W. Loeser, Jr. 19 Jun. 1969 39 p refs
(Contract AT(30-1)-2137)
(PPAR-13) Avail: CFSTI

The decays of $^{116,118,120,122}I$ were studies using isotopically separated sources produced by proton spallation of La. Ge(Li) γ singles spectra and Ge(Li) - Ge(Li) coincidence spectra were obtained and used in constructing level schemes for the corresponding tellurium daughters. Author (NSA)

N69-41281# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
ACCELERATOR PRODUCED ISOTOPES
K. Svoboda Dec. 1968 49 p refs Submitted for publication
(UJV-2115-Ch) Avail: AEC Depository Libraries

A review of radioisotopes commercially produced by cyclotraons is given along with some properties and the name of the producers. Data on specific cyclotrons for radioisotope production are tabulated. The advantages of cyclotron-produced isotopes and reactor-produced isotopes are evaluated NSA

N69-41286# California Univ., Davis. Crocker Nuclear Lab.
OPERATOR REDUCTION OF THREE-BODY SCATTERING EQUATIONS
Peter A. Kazaks Aug. 1968 64 p
(Contract AT(11-1)-GEN-10)
(UCD-CNL-101) Avail: CFSTI

Operator multipliers of the Lippman-Schwinger (L-S) equation are used to obtain calculable and unique solutions. The multiplier method is used as a basis for determining the relation between various formulations of the three-body problem. The properties of the multipliers determine whether the multiplied equation yields fewer, extra, or unchanged bound state solutions. It is pointed out that the noncompact kernel of the L-S equations for three-body problems both renders the solutions incalculable and produces non-unique solutions for the wave functions. The method proposed by Sugar and Blankenbecler to make the kernel compact is examined. It is found that the inverse of their arbitrary operator L must exist in order not to reduce the number of bound states. Using a specific operator L or M as a multiplier of the L-S equations formal but calculable solutions are obtained. Author (NSA)

N69-41289# California Univ., Los Angeles. Physics Dept.
CALIBRATION OF A PHOTON DETECTOR USING A MONOENERGETIC PHOTON BEAM
A. J. Weiss, B. M. K. Nefkens, and L. J. Verhey May 1969 30 p refs
(Contract AT(11-1)-34)
(UCLA-34-P-106-33-Rev) Avail: CFSTI

Several large scintillation detectors of the lead-plastic sandwich type have been constructed for use as anti-counters in an experiment designed to study radiative pion capture, $\pi^- p \rightarrow \gamma n$. This process was investigated at pion kinetic energies of 200, 320, and 360 MeV for the purpose of studying the $P_{33}(1236)$ and $P_{11}(1400,$ Roper) resonances. At these energies the charge exchange reaction $\pi^- p \rightarrow \pi^0 n \rightarrow 2\ \gamma n$ exhibits a cross section which is, at some angles, several hundred times larger than that for radiative capture. The large π^0 background can be reduced by vetoing events having one of the decay gammas striking an anticounter. The efficiency of these counters depends on the photon energy, especially in the range 100 MeV and below. The photons to be discriminated against typically have energies in the range 20 to 300 MeV. The measurements were performed using the facilities of the California Institute of Technology Synchrotron Laboratory. Author (NSA)

N69-41295# Purdue Univ., Lafayette, Ind. Chemistry Dept.
DEEXCITATION PROCESSES IN NUCLEAR REACTIONS Progress Report, May 1968 - Apr. 1969
Norbert T. Porile May 1969 39 p refs
(Contract AT(11-1)-1505)
(COO-1505-33) Avail: CFSTI

Alpha and helium-3 reactions at 15 to 45 MeV, isomeric cross section ratios, and recoil and differential range studies are given for barium and copper isotopes. Charge distribution and recoil properties of fragments from proton fission at 11.5 GeV are presented for lead 208 and uranium 238. NSA

N69-41301 European Organization for Nuclear Research, Geneva (Switzerland).
ELECTRON SCATTERING, FORM FACTORS, VECTOR MESONS
A. Minten 12 Aug. 1969 62 p refs
(CERN 69-22) Avail: Issuing Activity

The classification of electromagnetic scattering, generally referred to as Coulomb scattering, treated in the approximation of one-photon exchange; the definition, measurement, and interpretation of nucleon, pion, and electron form factors, as they are measured by Coulomb scattering, and the formation of strongly interacting states, such as vector mesons, by annihilation or e^+e^- pairs, and the relation to the crossed process, namely the electron scattering were studied with emphasis on the basic ideas and formalisms, and not on completeness. Author

N69-41302# Brookhaven National Lab., Upton, N.Y.
PLASMA BETATRON STUDY
Lawrence A. Ferrari and Martin S. Zucker Dec. 1968 93 p refs
(BNL-1324) Avail: CFSTI

After a brief introduction and review of previous plasma betatron experiments, the economic and technological aspects of this type accelerator are discussed. Topics included are particle motion in confined betatron and azimuthal magnetic fields, electrostatic effects, capture into beatatron orbits in a plasma betatron, the $B\dot{\Theta}$ turn-on problem, beam loss by gas scattering, synchrotron radiation, obtainable radiation dose, apparatus and preliminary research program, and economics of the plasma betatron and possible future developments. NSA

N69-41303# Los Alamos Scientific Lab., N.Mex.
OPERATION OF A RADIO FREQUENCY NUCLEAR SPIN FILTER
Gerald G. Ohlsen, Joseph L. Mc Kibben, R. Ralph, Jr., George P. Lawrence, and Ned A. Lindsay Feb. 1969 18 p refs
(Contract W-7405-eng-36)
(LA-4112) Avail: CFSTI

Details of the construction and operation of the nuclear spin filter in conjunction with the Los Alamos Scientific Laboratory Lamb-shift polarized-ion source are presented. Author (NSA)

N69-41334 Calif. Inst. of Tech., Pasadena.
EXPERIMENTAL STUDY OF ANTIPROTON-PROTON ANNIHILATION INTO A PAIR OF CHANGED PI-MESONS [FOR K-MESONS FOR INCIDENT ANTIPROTON MOMENTA IN THE RANGE FROM 0.72 GeV/c TO 2.62 GeV/c
Douglas Gun Fong (Ph.D. Thesis) 1968 190 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-503

The cross sections for the two antiproton-proton annihilation-in-flight modes, were measured for fifteen laboratory antiproton beam momenta ranging from 0.72 to 2.62 GeV/c. No magnets were used to determine the charges in the final state. As a result, the angular distributions were obtained. The events were analyzed by measuring the laboratory angle of the track in each chamber. The value of the square of the mass of the final particles was calculated for each event assuming the reaction $\bar{p} + p \rightarrow a$ pair of particles with equal masses. The average differential cross section of $\bar{p} + p \rightarrow \pi^+ + \pi^-$ varied from $\approx$ 25 μb/sr at antiproton beam momentum 0.72 GeV/c. The most striking feature in the angular distribution was a peak at $\Theta_{CM} = 90^\circ$ which increased with $\sqrt{s}$ and reached a maximum at $\sqrt{s} \approx 2.1$ GeV. A valley in the angular distribution occured at cos $\Theta_{CM} \simeq$ 0.4. The average differential cross section for $\bar{p} + p \rightarrow k^+ + k^-$ was about one third of that of the $\pi^{\pm}$ pair mode throughout the energy range of this experiment. Dissert. Abstr.

N69-41337# Hawaii Univ., Honolulu.
STUDY OF THE REACTION NEGATIVE PION PLUS PROTON YIELDS NEGATIVE PION PLUS NEGATIVE PION PLUS POSITIVE PION PLUS PROTON AT 3.9 GeV/c
P. G. Wohlmut, K. Abe, A. D. Johnson, and V.J. Stenger Apr. 1969 16 p Held at the Intern. Conf. on Elementary Particles, Lund, Switzerland
(Contract AT(04-3)-511)
(UH-511-48-69; CONF-690612-1) Avail: CFSTI

An excellent fit to 7975 events of the reaction $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ at 3.9 GeV/c was found using a model of pion-exchange, diffraction dissociation, and rho-exchange processes adding incoherently. Monte Carlo events generated according to the

model exhibit mass, momentum transfer, and angular distributions which are virtually identical with the real data in all major respects.
Author (NSA)

N69-41341# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimentalnoi Fiziki.
THE ELASTIC BACKWARDS SCATTERING OF PI-MESONS ON NEUTRONS IN THE INTERVAL OF IMPULSES 1.5 TO 3.8 GeV/c [UPRUGOE RASSEYANIE NAZAD PI-MEZONOV NA NEITRONAKH V INTERVALE IMPULSOV 1.5-3.8
V. D. Antopolskii, G. L. Bayatayan, and E. V. Brakhman 1969 24 p refs In RUSSIAN
(ITEF-638) Avail: AEC Depository Libraries

The elastic π^-_n backwards scattering in the momentum interval 1.5 to 3.8 GeV/c was investigated. The backwards scattering of pions was detected in spark chambers, surrounding the target with liquid deuterium; the forward scattering of neutrons was recorded in spark chambers of a neutron detector. Measuring the angle of backwards scattering of a pion and the point of interaction of the recoil neutron, it was possible to determine the kinematics of the elastic event. Data in regard to the dependence of the differential cross section on the energy in the momentum interval 1.5 to 3.8 GeV/c and the angular distribution for $-0.93 > \cos\theta^* > -1$ are presented.
Author (NSA)

N69-41354# Lockheed Missiles and Space Co., Palo Alto, Calif.
INTEGRATED ABSORPTION INDEX OF A GROUP OF ROTATIONAL LINES FOR AN EXPLOSION IN A SPHERICAL BOMB
A. D. Rusin 1969 5 p ref Transl. into ENGLISH from Vestn. Moscow Univ. Khim. (Moscow), no. 4, 1969 p 49–53
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Free radical concentrations in the thermal equilibrium produced during explosion in a spherical bomb are analyzed by considering the integrated absorption index of the individual spectral line of a diatomic molecule at the time of maximum pressure and by taking into account a pressure gradient. The temperature gradient has spherical symmetry, and local thermodynamic equilibrium is built up at each point of the volume until the time of maximum pressure is reached. Taking account of the temprature is simplest when the molecule distribution on a ray path is the same for all rays of the source of complex radiation incident on the bomb. This condition is satisfied for a light beam converging at the center of the bomb.
G.G.

N69-41377# Cambridge Electron Accelerator, Mass.
OPERATION OF THE CAMBRIDGE ELECTRON ACCELERATOR FOR FISCAL YEARS 1969, 1970, AND 1971
K. Strauch 1 May 1969 46 p
(Contracts AT(30-1)-2076; AT(30-1)-3025)
(CEAL-1048) Avail: CFSTI

Results of continuing work on the operation and further development of a 6-GeV electron synchrotron facility and support of an experimental program in particle physics are reported, and future plans for fiscal years 1970 and 1971 are outlined. Primary tasks include: (1) technical assistance in setting up experiments; (2) operation of experimental magnets, cryogenic targets, and vacuum systems for research projects; and (3)control of the on-line computer interface equipment tied in with an IBM 360/50 configuration at the Harvard Computation Center. The following services are also provided: (1) design and procurement of most of the heavy experimental equipment and its power circuitry; (2) design and construction or procurement of hydrogen targets, coolers and related cryogenic equipment; and (3) safety control of all experimental equipment.
A.C.R.

N69- 41380# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Chemistry.
NUCLEAR CHEMISTRY RESEARCH OF HIGH-ENERGY NUCLEAR REACTIONS AT CARNEGIE-MELLON UNIVERSITY Annual Progress Report, 1 Jun. 1968–31 May 1969
Albert A. Caretto, Jr. 1 Jun. 1969 193 p refs
(Contract AT(30-1)-2897)
(NYO-2897-35) Avail: CFSTI

Reaction mechanisms of simple nuclear reactions consisting of losses of one, two or three nucleons, taking place at proton bombarding energies in the range of 100 to 400 MeV were investigated. Reaction cross sections were measured for targets of Cu^{63}, Fe^{56}, Cr^{52}, Se^{77} and various isotopes of Te. The magnitude of the cross sections were compared with similar measurements on other target systems. A possible explanation for the trend obtainedin the data is suggested. Cross sections for the production of Na^{22} and Na^{24} were also determined from targets between Mg and Se with 100, 200 and 300 MeV protons.
Author

N69-41383# California Univ., Livermore. Lawrence Radiation Lab.
THRESHOLD-PHOTONEUTRON CROSS SECTIONS FOR LIGHT NUCLEI
Ruby Lee Van Hemert (M.S. Thesis) 23 Sep. 1968 90 p refs
(UCRL-50501) Avail: CFSTI

A fast response neutron detector built and tested at the Livermore linear electron accelerator has the following properties: a neutron detection efficiency of 12.7 to 3.2% for neutron energies between 2.1 keV and 3.5 MeV, an intrinsic response time of less than 5 nsec, a low sensitivity to the gamma flash associated with the electron beam burst and a good background rejection capability. The fast response neutron detector was used for threshold photoneutron measurements; and the differential cross sections at 135° for the isotopes ^{10}B, ^{24}Mg, ^{28}Si, ^{32}S, ^{40}Ca, ^{19}F, ^{25}Mg, ^{26}Mg, and ^{31}P were then obtained. The typical experimental energy resolution ranged from 0.3 MeV for neutrons having an energy of 3.4 MeV to 0.01 keV for neutrons having an energy of 2.31 keV. The proton energies ranged from 7.0 to 19.5 MeV. The measurements were made with bremsstrahlung endpoint energies ranging from threshold to several MeV above threshold.
Author (NSA)

N69-41385# Addis Translations International, Woodside, Calif.
BASIC PRINCIPLES OF A HIGH-DUTY-CYCLE ELECTRON-RING ACCELERATOR [GRUNDKONZEPTION EINES DAUERSTRICH-ELEKTRONENRING BESCHLEUNIGERS]
H. Hultschig May 1969 10 p refs Transl. into ENGLISH from German Report In ENGLISH and GERMAN Sponsored by AEC
Prepared for Lawrence radiation Lab.
(UCRL-Trans-1396) Avail: CFSTI

An effort is made to conceive of an electron-ring accelerator that in principle would allow a repetion frequency greater than 10^6 Hz. Here the repetition frequency, as in earlier proposals, is limited by the charging with protons and forming of the ring. If conventional linacs are used to accelerate the injected electrons, and possibly for subsequent acceleration of the rings, they will probably impose an upper limit on the repetition frequency, of the order of several kHz, so that the frequency possible with the electron-ring accelerator discussed can be achieved only with superconducting linacs.
Author (NSA)

N69-41387# Institute of Nuclear Research, Warsaw (Poland)
PSEUDOSCALAR MESON PRODUCTION AND THE QUARK MODEL
M. Szeptycka and T. Hofmokl 1968 11 p refs
(INR-P-1047) Avail: AEC Depository Libraries

Predictions of the quark model are compared with the experimental data for the production of the pseudoscalar meson and

a strong disagreement has been found for the π^0 and K^0 mesons. Author (NSA)

N69-41394# Rensselaer Polytechnic Inst., Troy, N.Y.
LINEAR ACCELERATOR PROJECT Progress Report, 1 Jan. – 31 Mar. 1969
31 Mar. 1969 72 p refs
(Contract AT(30-3)-328)
(RRI-328-160) Avail: CFSTI

Thermal energy and neutron spectrum measurements are reported for the linear accelerator materials cadmium, aluminum, hafnium, tungsten, and lead. Also studied are design and efficiency of boron-10 carbide sodium iodide scintillation detectors in neutron reactor control and fast neutron measurements. Spin assignments are made for some plutonium and rhodium isotopes and tungsten neutron resonances. The time dependence and distribution of a uranium neutron flux in a pulsed fast assembly is also obtained. G.G.

N69-41398# Gulf General Atomic, San Diego, Calif.
INTEGRAL NEUTRON THERMALIZATION Quarterly Progress Report, 1 Jan. – 31 Mar. 1969
E. L. Slaggie, G. M. Borgonovi, D. H. Houston, and J. M. Neil 17 Apr. 1969 37 p refs
(Contract AT(04-3)-167)
(GA-9326) Avail: CFSTI

Previous measurements of the single differential cross section for neutron scattering by a Be single crystal have now been analyzed. The cross section was put on an absolute basis by using as a reference the scattering from a small disc of polyethylene having about the size of Be single crystal. The results are graphed. The coherent scattering law $S(\alpha,\beta)$ for polycrystalline Be was calculated for β = 0.5, 1, 1.5, and 2, and the results are plotted. The thermal expansion and phonon frequency shifts in an arbitrary crystal lattice are investigated theoretically. The code QSCAT was used to calculate the coherent elastic neutron scattering by UC and UO sub two. NSA

N69-41399# Idaho Nuclear Corp., Idaho Falls.
RESONANCE INTEGRAL MEASUREMENTS
R. P. Schuman and J. R. Berreth May 1969 34 p refs
(Contract AT(10-1)-1230)
(IN-1296) Avail: CFSTI

Resonance integrals were measured for a number of nuclides by reactor activation inside cadmium shields. The values were determined relative to thin ^{197}Au (R.I. = 1558 b) and include the 1/v contribution from the thermal cross sections. Thin-sample resonance integrals were measured for ^{55}Mn (14.0 ± 0.7 b), ^{59}Co (74.6 ± 3 b), ^{93}Nb (8.5 ± 0.5 b), ^{94}Nb (125 ± 8 b), ^{181}Ta (640 ± 60 b), ^{236}U (381 ± 30 b), ^{237}Np (807 ± 40 b), ^{243}Am (111 ± 10 b to 10.1 hr ^{244}Am, 2160 ± 120 b to both isomers), ^{241}Am (850 60 b to 16 hr ^{242}Am, 250 ± 40 b to 152 yr ^{242m}Am), 152 yr ^{242m}Am (7000 ± 2000 b total), ^{242}Cm (150 ± 40 b to ^{243}Cm), ^{244}Cm (650 ± 50 b to ^{245}Cm), ^{245}Cm (680 ± 300 b total), and ^{246}Cm (110 ± 40 b to ^{247}Cm). Effective thick sample resonance integrals were measured for tantalum, cobalt, and gold. Some thermal cross sections and gamma-ray abundances were also obtained. Author (NSA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N69-40077*# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
IONOSPHERIC RESEARCH: THE INTERACTION OF AN OBLIQUELY INCIDENT p-POLARIZED PLANE ELECTROMAGNETIC WAVE WITH A HOT PLASMA HALF-SPACE AND PLASMA SLAB
Paul E. Bolduc 15 Sep. 1969 146 p refs
(Grant NGL-39-009-003)
(NASA-CR-106345; SR-338) Avail: CFSTI CSCL 20I

A relativistic kinetic theory description of the interaction of a plane p-polarized electromagnetic wave obliquely incident on a hot plasma half space and plasma slab is developed. The Laplace transform technique, together with the radiation condition and the condition of specular reflection of the electrons at the interface, is used to obtain unique linearized solutions for the fields and the particle distribution in a plasma half space. The above procedure is modified to treat the case of the plasma slab. A proof of self-consistency is presented in the treatment of both the slab and the half-space problems. The elementary nonequilibrium thermodynamics of the interaction is discussed in the case of the plasma half space. Power reflection and transmission coefficients are obtained for both problems. Author

N69-40111# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DISCONTINUITY THEORY IN MAGNETOHYDRODYNAMICS
I. V. Ioffe et al 27 Nov. 1968 6 p refs Transl. into ENGLISH from Magnitn. Gidrodinam., Akad. Nauk Latv. SSR (Riga), no. 4, 1967 p 143 – 144
(AD-692047; FTD-HT-23-981-68) Avail: CFSTI CSCL 20/9

The structure of discontinuities is discussed in conducting fluids in the presence of external electric fields. It is shown that rarefaction wave is possible in liquid metals. TAB

N69-40149# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
INSTABILITIES AND GROWING WAVES: POWER ABSORBED OR GENERATED BY THE VARIOUS EXCITED MODES IN A PLASMA [INSTABILITES ET ONDES CROISSANTES: PUISSANCE ABSORBEE OU ENGENDREE PAR LES DIFFERENTS MODES EXCITES DANS UN PLASMA]
Paul Rolland (Ph.D. Thesis–Paris Univ., 12 May 1969) Aug. 1969 117 p refs In FRENCH; ENGLISH summary
(CEA-R-3862) Avail: CFSTI

The stable or unstable character of a medium can be deduced from the behavior of an ideal model of a semi-infinite medium which is subjected to an excitation at the boundary. A new analytic method is used to solve this problem. The results obtained show a connection between the character of the medium and certain properties of the dispersion equation, and agree with those derived from other methods. The energy exchange between a medium and a source of excitation is also investigated. In order to include the case of growing waves associated with convective instabilities, this problem is treated in the context of the wave-packet theory. It is found that even in the absence of collisions there still is a power exchange. Thus a connection can be established with the kinematic theories of growing waves and the mode generating power can be found. Moreover, the power absorbed by spatial dispersion is found to be identical with that due to Landau's effect for long waves. This confirms the kinematic character of the latter and bridges a gap between macroscopic and microscopic theories. Author (ESRO)

N69-40166 California Inst. of Tech., Pasadena.
EXPERIMENTAL STUDY OF THE UPPER HYBRID ECHO IN PLASMAS
Luc-Olivier Bauer (Ph.D. Thesis) 1968 170 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-489

The two-pulse stimulated radiation of dense ($10^9/cm^3 > ne \leq 10^{11}/cm^3$) nonuniform neon and argon afterglow plasma

columns longitudinally immersed in a magnetic field is studied. The magnetic field is very homogeneous over the plasma volume. If the S-band microwave pulses' center frequency is such that they resonantly excite a narrow band of plasma upper hybrid oscillations close to the maximum upper hybrid frequency of the column, strong two-pulse echoes are observed. This new echo process is called the upper hybrid echo. The echo spectrum, echo power and echo width were studied as a function of the pulse peak power, pulse separation, relative density, and relative cyclotron frequency. The complex but systematic variations of the echo properties as a function of the above-mentioned parameters are found to be in qualitative agreement with those predicted by a theory based upon a simple nonuniform unidimensional cold plasma slab model. Dissert. Abstr.

N69-40167 Connecticut Univ., Storrs.
IONIC PUMPING VIA SYNCHRONIZED ELECTRIC AND MAGNETIC FIELDS
Chen Hsing-Yao (Ph.D. Thesis) 1968 103 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-2106

The possibility of applying a synchronized crossed field pumping mechanism to ionized gas or plasma is studied. A differential equation of ion motion in a synchronized crossed field has been derived and solved, and a set of acceleration, velocity and position equations are obtained as the solution of the differential equation. These solutions reveal that under the synchronized crossed field condition a controlled ion motion can be obtained with a net acceleration in the direction of migration. Also, the condition for both controlled electron and ion motion is discussed. Dissert. Abstr.

N69-40194# Rome Univ. (Italy). Centro Ricerche Aerospaziali.
PLASMA GENERATOR OF THE AEROSPACE RESEARCH CENTER [L'IMPIANTO GENERATORE DI PLASMA DEL CENTRO RICERCHE AEROSPAZIALI]
Carlo Buongiorno and Vittorio Fiorini Jul. 1968 30 p refs In ITALIAN; ENGLISH summary
(Rept-17) Avail: CFSTI

A brief description of a 40 kW dc Arc-Jet installation designed at Centro Ricerche Aerospaziali is given. The arc jet which is of the coaxial geometry with watercooled electrodes is installed in a vacuum chamber and discharges in a low pressure (below 3 mm Hg) environment. Data are given on jet calibration that have been obtained with calorimeter techniques at ambient pressure, and the efficiency of the plasma jet is determined. Author

N69-40284# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIATION OF AN EXPLODING WIRE IN VACUUM
E. K. Chekalin et al 19 Jun. 1968 10 p refs Transl. into ENGLISH from RUSSIAN J.
(AD-692145; FTD-MT-24-94-69) Avail: CFSTI CSCL 20/9

Experiments were carried out to study the radiative characteristics of the process of exploding thin (0.3 MM diameter) copper wire 100 MM long in vacuum. The vacuum was considered sufficient for elimination of secondary radiation and absorption effects which accompny the process in a gas medium. The initial voltage on a capacitor bank was 30 kv. The discharge period was 45 micro sec, with a current maximum up to 150 kamp. The experimental setup and the method are described in fair detail. An analysis of a motion picture taken along the wire axis and time-scan spectral photographs taken through a narrow split parallel to the wire displays, besides the spectral lines of copper, flashes of continuous spectra. These flashes occur when the luminous regions within the plasma moving away from the electrodes toward each other arrive at the central area of the wire. The nature of these continuous spectra appears to be similar to the continuous spectrum at the beginning of the process. The presence of the absorption spectrum indicates that the temperature corresponding to the luminosity of the continuous spectrum is higher than the electron temperature in the outer layers of the expanding plasma cloud. No absorption spectrum was observed in the red region. TAB

N69-40350# Royal Inst. of Tech., Stockholm (Sweden). Plasma Physics Div.
ELECTRIC PROBE MEASUREMENTS IN A MOVING MAGNETIZED PLASMA
L. Lindberg and L. Kristoferson Aug. 1969 38 p refs
(Rept-69-16) Avail: CFSTI

During the development of an electrodeless plasma accelerator (conical theta pinch) high impedance electric probes have been used to measure electric potential and electric fields in the plasma, amd floating double probes have been used to measure density and temperature. The plasma is almost collisionfree and moves in a longitudinal or transverse magnetic field, such that the electron gyro radii are of the same order as the probe radii ($B = 0.01 - 0.04\ Vs/m^2$). The ion gyro radii are large and the translation velocity of the ions dominates over their thermal velocities. Typical values of density, temperature and velocity are: $10^{19} m^{-3}$, 10^5 °K, $20-30 \cdot 10^4$ m/s resp. and the plasma is almost fully ionized. Basic theory is briefly discussed and a circuit with fast response for high impedance potential probe measurements as well as an experimental method to check the reliability of such measurements are described. Measurements of electron density and temperature by means of various types of floating double probes are compared and the density measurements agree to within a factor of two with microwave interferometer measurements. A sweep circuit is described allowing the double probe characteristic to be recorded in two microseconds repeatedly. Author (ESRO)

N69-40353# Joint Publications Research Service, Washington, D.C.
PHYSICS OF HIGH-TEMPERATURE PLASMAS
L. A. Artsimovich 10 Oct. 1969 25 p refs Transl. into ENGLISH from Priroda (Moscow), no. 8, Aug. 1969 p 2-13
(JPRS-49025) Avail: CFSTI

Magnetic maintenance of thermonuclear plasma is discussed. Toroidal equipment is described in which maintenance of the plasma equilibrium rests on the magnetic field of the current while the stability is provided by a very strong longitudinal field. Theoretical analysis and applications of the equipment in high temperature plasma research are reviewed. J.A.M.

N69-40516# Royal Inst. of Tech., Stockholm (Sweden). Plasma Physics Div.
ON THE INTERACTION BETWEEN A PLASMA AND NEUTRAL GAS
Lars Danielsson Jun. 1969 29 p refs
(Rept-69-17) Avail: CFSTI

In an experiment where a high velocity plasma stream penetrates a stationary neutral gas cloud in a magnetic field, it is found that the interaction between the plasma and the gas is far more violent than can be expected from simple atomic interaction theories. The parameters are such that the character of the interaction is collisionless. The observations demonstrate that the plasma is very efficiently retarded as it penetrates into the gas cloud and that the electron energy distribution changes drastically towards higher energies, at least for a part of the population, resulting in partial ionization of the gas. In order to account for the observations it is necessary to assume some kind of collective interaction between the plasma and the neutral gas. The results are analysed from the point of view of Alfvén's critical velocity hypothesis. Author (ESRO)

N69-40805# California Univ., Los Angeles. Physics Dept.
EFFECT OF FOKKER-PLANCK COLLISIONS ON PLASMA

WAVE ECHOES

George L. Johnston Jun. 1969 16 p refs

(Grants NGR-05-007-116; NSF GP-6817; Contracts NONR-4756(01); AT(11-1)-34; Proj. -157)

(AD-691746; R-50) Avail: CFSTI CSCL 20/9

The effect on plasma wave echoes of Coulomb collisions described by a complete Fokker-Planck collision term is determined theoretically by application, in first and second orders, of the particular integral of a linearized kinetic equation which is capable of describing a Fokker-Planck collisional kinetic equation in the resonant region. Author (TAB)

N69-40607# California Univ., Los Angeles. Physics Dept.

LINEAR AND NONLINEAR THEORY OF GRID EXCITATION OF LOW FREQUENCY WAVES IN A PLASMA

George L. Johnson Jul. 1969 36 p refs

(Grant NGR 05-007-116; NSF GP-6817; Contract NONR-4756(01); AT(11-1)-34; Proj. 157)

(AD-691883; R-51) Avail: CFSTI CSCL 20/9

The steady-state excitation of longitudinal waves by a pair of idealized grids immersed in a collisionless plasma and driven at a frequency small compared with the ion plasma frequency is investigated theoretically. In linear theory the Fourier-inversion integral which determines the spatial behavior of the potential in the plasma is expressed as a sum of two integrals which embody the interactions of phase-velocity components of the wave with ions and electrons. An appropriate choice of the deformed contour of integration permits evaluation of the response as the sum of the residue of the dominant ion-acoustic pole and of the two branch-cut integrals. A perturbation-series expansion of the potential and the species distribution functions in the (nonlinear) Vlasov equation yields a hierarchy of equations. In each order the equations are linear in the perturbation quantities of that order and have driving terms composed of quadratic combinations of lower-order quantities. Author (TAB)

N69-40622# Westinghouse Electric Corp., Pittsburgh, Pa. Applied Physics and Mathematics Research Labs.

BASIC PLASMA PROCESSES. Yearly Summary Technical Report, 1 Jul. 1968 - 30 Jun. 1969

A. V. Phelps 25 Jul. 1969 70 p refs

(Contract Nonr-4725(00))

(AD-691470; Rept-69-9C8-GASES-R1) Avail: CFSTI CSCL 20/9

The resonance radiation emitted by thermally excited cesium vapor was observed at a temperature of 800K and cesium densities between 3.7 and 37 x 10 to the 16th power atoms/cc. The spectral distribution of the radiation shows the line reversal effects expected for a finite rate of production of excited atoms. Measurements of the magnitude and wavelength dependence of the specular reflection of light in the vicinity of the resonance line have been extended to cesium densities near 6 x 10 to the 17th power atom/cc and support the Taylor-Langmuir formula for the equilibrium cesium vapor pressure rather than the recent results of Volyak, Vinogradev and Anisemov. The theoretical studies of the backscattering of resonance radiation have been extended to include the effects of the non-radiative transport of excited resonance atoms to boundaries, such as the windows of the experimental cell. The theory was also extended to include illumination by narrow line sources, such as the resonance line source used in the studies of mercury vapor by Hansen and Webb. Author (TAB)

N69-40898# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Institut.

EXTENSION OF THE LIMITS OF MEASUREMENT OF PLASMA DENSITY BY MEANS OF A LASER INTERFEROMETER WITH PHASE MODULATION OF THE OPTICAL SIGNAL

L. A. Dushin et al. 1968 8 p refs In RUSSIAN

(FTI-165) Avail: AEC Depository Libraries

A laser interferometer, capable of measuring nL of plasma from 10^{14} to 10^{17} el/cm^2, is discussed (n is electron density and L is path length signal). NSA

N69-40903# Aerospace Corp., El Segundo, Calif. Lab. Operations.

STEADY STATE PLASMA GENERATED BY STRONG, HIGH FREQUENCY FIELDS Technical Report, Sep. - Dec. 1968

Melvin Epstein 1 Aug. 1969 31 p refs

(Contract F04701-69-C-0066)

(AD-691818; TR-0066(5240-20)-2; SAMSO-TR-69-227) Avail: CFSTI CSCL 20/9 Supersedes (TR-0200 (4240-20)-8)

The steady state plasma generated by a strong, high frequency electromagnetic wave normally incident on a slab of gas is analyzed, and the electron density distribution in the slab, as well as the propagation characteristics of the discharge, are described as functions of the strength of the incident signal. The analysis is based on the simultaneous solution of the electron diffusion equation and Maxwell's equations, including the transition from free to ambipolar diffusion. The results provide predictions of the fields required to produce breakdown, the fields required to maintain the discharge, and the power transmitted through the slab as a function of the strength of the incident field. Author (TAB)

N69-40971 Princeton Univ., N.J.

AN EXPERIMENTAL STUDY OF ION CYCLOTRON WAVES IN A HOT PLASMA

Myron F. Uman (Ph.D. Thesis) 1968 91 p

Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-2565

According to the theory of the propagation and absorption of ion cyclotron waves in a hot plasma, the wavelength approaches a minimum, non-zero value as the wave propagates into a magnetic beach where the wave frequency approaches the local ion cyclotron frequency. Observations of a plasma, confined in a linear magnetic mirror machine, for perpendicular ion temperatures in the range of 10 to 110 eV are presented. The theory is developed for the transport of amplitude of waves in a hot, finite plasma immersed in an inhomogeneous magnetic field. Quantitative agreement between theory and experiment is obtained. These measurements represent the first experimental observations of thermally-broadened collisionless cyclotron absorption in a laboratory plasma. Dissert. Abstr.

N69-40986# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.

MULTIMODE OSCILLATION AND AMPLIFICATION IN PINCHED ELECTRON-HOLE PLASMAS

Wen S. Chen and Betsy Ancker-Johnson Jun. 1969 9 p refs

(AD-691359; D1-82-0877) Avail: CFSTI CSCL 20/12

An azimuthally symmetric perturbation in the density distribution of a pinched electron-hole plasma produces spontaneous pinch oscillations which grow in time and space. Applied waves with this symmetry are amplified as they propagate down the pinch while the plasma is biased just below the current threshold for spontaneous oscillation. Magnetic fields applied parallel to the current cause helical perturbations to grow. Waves with helical symmetry grow markedly only when the plasma is just below its pinch threshold. Phase-discriminating wave amplification is achieved when the plasma is properly biased. Author (TAB)

N69-41003# United Kingdom Atomic Energy Authority, Culham (England). Culham Translations Office.

DETERMINATION OF THE PARAMETERS OF A PLASMA FORMED BY THE EFFECT OF MICROWAVE POWER IN A MAGNETIC FIELD STEADY-STATE CONDITIONS.

A. Anisimov et al. Apr. 1969 13 p refs Transl. into ENGLISH

from Russian Report No. FTI-115
(NP-tr-1789) Avail: CFSTI

A plasma was produced by using microwave power in the 3-cm-wavelength range in the electron cyclotron resonance condition. Measurements were carried out in hydrogen at pressures of 5×10^{-4} to 10^{-2} torr and an applied microwave power of the order of 200 W. The steady-state charged-particle concentration was in the range from 10^{11} to 10^{13} cm^{-3}, and the electron temperature from 1.5 to 15 eV. The experimental results are analyzed on the basis of the balance equation. Author (NSA)

N69-41009# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON PLANE ELECTROMAGNETIC WAVE SCATTERING BY TWO PARALLEL RADIALLY INHOMOGENEOUS ANISOTROPIC PLASMA CYLINDERS
A. V. Moshinskii [1969] 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk Belorussk. SSSR, Ser. Fiz.-Mat. Nauk (Minsk), no. 4, 1969 p 12-18
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Multiple wave scattering by two plasma cylinders, the magnitude of which depends on the cross-section of the cylinders, the distance between them, and the plasma parameters, is discussed. A series of equations is derived to calculate the plasma domains, radial functions, amplitude functions, and radar scattering cross-sections. R.B.

N69-41021# Stanford Univ., Calif.
RELATION BETWEEN HELICAL, ION ACOUSTIC AND DRIFT INSTABILITIES
F. W. Crawford, A. J. Duncan, J. R. Forrest, and S. A. Self May 1969 6 p refs Presented at the Third European Conf. on Controlled Fusion and Plasma Phys., Utrect, Netherlands, Jun. 1969
(Contract AT(04-3)-326)
(SU-IPR-296; CONF-690619-1) Avail: CFSTI

The results from a theoretical study of the various instabilities in positive column discharges are discussed. The conditions for the occurrence of each instability are described. NSA

N69-41031# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Institut.
TURBULENT PLASMA IN A STELLARATOR
P. Ya. Burchenko, B. T. Vasilenko, E. D. Volkov, R. M. Nikolaev, V. A. Potapenko, et al. 1968 13 p refs In RUSSIAN
(FTI-190) Avail: AEC Depository Libraries

Data are given on the oscillation processes in plasma which exert a considerable influence on the plasma heating rate and losses in the trap. Experiments were carried out in the "Sirius" stellarator, design and specifications of which are included. An ohmic discharge with 1-msec current pulse duration was used for plasma heating. The experiments used a neutral helium pressure from 2×10^{-5} to 5×10^{-4} mm Hg, electrical field potential from 0.08 to 0.4 V/cm, and magnetic field from 4 to 16 kOe. The plasma cylinder current, chamber intensity, density and diamagnetism of plasma, density distribution along the plasma cylinder cross section, fluctuations of the floating potential, and X-ray and microwave emissions were recorded and analyzed. Author (NSA)

N69-41047# Sandia Corp., Albuquerque, N. Mex.
IMPROVED PINCH DEVICE: COMPARISON WITH THEORY
R. A. Gerber and J. R. Freeman Jul. 1969 34 p refs Sponsored by AEC
(SC-RR-69-441) Avail: CFSTI

The inverse-pinch geometry has recently been used in studies involving ionizing and collisionless shocks, blast waves, and current-sheet stability. This work discusses an improved inverse-pinch device capable of achieving higher shock velocities than previously obtained. An exploding wire-dielectric switch is used to increase the rate of current input. The measured luminous front velocities exceed those previously reported for similar ambient hydrogen pressures. The experimental results are compared with a one-dimensional hydromagnetic model. Results of this single fluid hydrodynamic code are shown to compare favorably with the experimental data. Author (TAB)

N69-41082# United Kingdom Atomic Energy Authority, Culham (England). Translations Office.
PLASMA ENERGY LIFETIME AND DISCHARGE PARAMETERS IN TOKAMAK-3
E. P. Gorbunov, S. V. Mirnov, and V. S. Strelkov May 1969 27 p refs Transl. into ENGLISH of Russian Report IAE-1681, Sep. 1968 p 1-24
(NP-tr-1798; CTO-619) Avail: AEC Depository Libraries

The thermal isolation of plasma in tokamak-3 is discussed. The plasma energy lifetime τ_E was plotted against the following discharge parameters: the stabilizing magnetic field H_z, the particle density n_e, and the discharge current I. In the region of densities $n_e \geq 2 \times 10^{13}$ cm^{-3} τ_E is practically independent of H_z, in the region $n_e \approx 1$ to 5×10^{13} cm^{-3}, τ_E increases slightly with n_e, and proportionally with the current I. The experimental results conform satisfactorily to the empirical formula. Author (NSA)

N69-41089# Addis Translations International, Woodside, Calif.
SOME PROPERTIES OF RELATIVISTIC PLASMA RINGS [EINIGE EIGENSCHAFTEN RELATIVISTISCHER PLASMARINGE]
Wilhelm H. Kegel May 1969 49 p refs Transl. into ENGLISH from German Report IPP-1 In ENGLISH and GERMAN Sponsored by AEC Prepared for Lawrence Radiation Lab.
(UCRL-Trans-1397) Avail: CFSTI

In connection with the project of the electron ring accelerator (ERA), plasma rings are considered which consist of electrons with a relativistic mean velocity and fewer ions with a low mean velocity. The purpose of this report is to derive some necessary conditions for such systems to be in equilibrium. From the relativistic Vlasov equation in cylindrical coordinates moment equations are derived. From these it follows that the electrons are restricted to a finite volume, if one assumes that all macroscopic quantities of the ring vanish at infinity. Separate radial and axial virial theorems for ions and electrons are derived from the moment equations. They relate the average pressure with the integrals over the spatial moments of the electric and magnetic forces. These relations show that in general the ion pressure is anisotropic. Author (NSA)

N69-41148# New Mexico Univ., Albuquerque. Nuclear Engineering Dept.
DEVELOPMENT OF A MODIFIED CHAPMAN-ENSKOG SOLUTION OF THE LENARD-BALESCU EQUATION FOR TWO TEMPERATURE PLASMAS
W. F. Walters 1969 6 p refs Held at the 9th Intern. Conf. on Phenomena in Ionized Gases, Bucharest, Romania Sponsored by Sandia Lab.
(SC-CR-69-3174; Conf-690803-2) Avail: CFSTI

In the classical Chapman-Enskog method of solution, a very small expansion parameter ϵ is chosen, so small in fact that all collision terms appear in the kinetic equation to the same order in spite of the fact that these terms differ by as much as a factor $(m_e/m_i)^{1/2}$. Two-temperature plasmas are such that unlike-particle energy transfer is not dominant; hence, the portion of the interaction integral corresponding to unlike-particle energy transfer should, to agree with physical reality, appear in a higher order equation. It is found possible to split the electron-ion interaction integral into a

portion which, when moments of the equation are taken, accounts for momentum transfer and another portion which accounts for energy transfer. It is thus possible to identify, without ambiguity, a parameter $\epsilon = (m_e/m_i)^{1/2}$ which is appropriate to this class of systems. It is noted that, at a small expense in accuracy (terms $O(\epsilon)^2$ are neglected), it is found possible to develop a rigorous method of solving the Lenard–Balescu kinetic equation for this important class of nonequilibrium fully ionized plasmas.
Author (NSA)

N69-41149# Oak Ridge National Lab., Tenn.
EVOLUTION AND STABILIZATION OF FLUTES IN A MAGNETIC MIRROR
R. J. Colchin, J. L. Dunlap, and H. Postma. Jun. 1969. 50 p refs. Submitted for Publ.
(ORNL-TM-2639) Avail: CFSTI

A hot-ion, low-β plasma was established in an adiabatic, simple mirror trap by Lorentz or gas-collisional ionization of an energetic H^0 beam. The studies emphasize: (1) the detailed evolution of the flute mode and comparisons with linear theory and (2) the stabilizing effects of increased electrical connection of the plasma to conducting end walls (line-tying). The evolution is traced as a function of density from a stable drift wave at low density to threshold for a growing, unstable wave that quickly exhibited nonlinear frequency behavior. Instability threshold seems to occur at a somewhat higher density than that calculated even from theories treating bounded plasmas. The line-tying experiments used movable end walls as a control on the electrical connection. Threshold was raised with end walls close to the hot plasma in a fashion that is in qualitative agreement with a recent calculation. Two possible explanations of the nonlinear frequency behavior of the unstable wave are proposed.
Author (NSA)

N69-41159 Princeton Univ., N.J.
TRANSIENT DOUBLE INJECTION IN SEMICONDUCTORS
Raymond Harkless Dean (Ph.D. Thesis). 1968. 186 p.
Avail: Univ. Microfilms. HC $8.60/Microfilm $3.00. Order No. 69-2736.

When a step voltage is applied to injecting contacts on the ends of a long semiconducting bar, an electron-hole plasma forms at the minority-carrier injecting end and propagates down the length of the sample. The transient behavior of this plasma phenomenon is described theoretically and observed experimentally in room-temperature p-type germanium. In the sample tested drift effects dominate diffusion effects over most of the length and deep trapping is negligible. An exact theoretical solution is obtained in in the limit in which the (monomolecular) recombination time is much longer than the small-pulse transit time. A pair of probes is used to measure directly the time-varying field profile. The current and time derivative of the current are measured with a series resistor and passive differentiator circuit. The minority-carrier mobility and recombination time which appear in the theoretical formulas are measured by conventional techniques. There is excellent agreement between the experimental results and the theory. The cusp is used to measure the minority-carrier mobility, thereby demonstrating a new simple technique for determining this parameter.
Dissert. Abstr.

N69-41163*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
CORRELATION EFFECTS IN SEMI-INFINITE PLASMAS
Ralph L. Guernsey. Jun. 1969. 48 p.
(Grant NGL-21-002-005)
(NASA-CR-106480; BN-613) Avail: CFSTI

The system of a fully ionized gas combined to a half space by a perfectly reflecting boundary is discussed. It is shown how the effect of pair correlation can rigorously be taken into account in both the equilibrium and nonequilibrium theory.
Author

N69-41179# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.
STUDY OF ENERGY LOSSES AND EFFECTIVENESS OF TURBULENT HEATING OF PLASMA BY CURRENT
Yu. G. Kalinin, D. N. Lin, V. D. Ryutov, and V. A. Skoryupin. 1968. 20 p refs. In RUSSIAN.
(IAE-1656) Avail: AEC Depository Libraries

Turbulent heating and energy losses from a plasma in an open trap were studied. It is demonstrated that the effectiveness of heating increases with the expansion of the magnetic field in which the heating is conducted, and with the rise in the initial density of the charged particles in the trap. The maximum effectiveness of the heating achieved in the experiments is 25%. The authors link the heating of the plasma with the development of ion-acoustic instability. During the turbulent heating, there is an appreciable transport of the plasma energy both across and along the sustaining magnetic field, reducing significantly the plasma's energy content. By reducing these losses, one can probably increase greatly the integral effectiveness of the heating.
NSA

N69-41196# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
[RESEARCH ON PLASMA DISCHARGE, HEATING, AND PROPERTIES] Annual Report, 1967
1967. 157 p refs. In GERMAN; ENGLISH summary.
(NP-17732) Avail: AEC Depository Libraries

In the Experimentelle Abteilung I, fast gas discharges were investigated. The effect of the field inhomogeneities, proceeding from homogeneous magnetic fields, which are unavoidable in a transition to a closed ring arrangement, was determined. A large number of studies in the area of very high temperatures was carried out with the theta-pinch arrangement, ISAR I. Work of the Experimentelle Abteilung 2 was divided into three problem areas. The first was concerned with the behavior of model plasmas of relatively well-known properties in relatively complicated magnetic arrangements. In the second, studies were concentrated on the interaction of a plasma and the radiation emitted by it in interactions with solid walls. In the third, properties of plasma in a magnetic field and its interaction with radiation of various frequency or with particle beams were investigated. In the Experimentelle Abteilung 3, experiments on the stationary heating of a plasma in strong external magnetic fields were continued. The work of the Abteilung Theorie comprised the broad range from studies devoted to basic questions for understanding the plasma behavior to studies directly concerned with evaluation or preparation of concrete experiments.
NSA

N69-41197# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Institut.
MECHANISM OF RESONANCE HEATING OF ELECTRONS IN BEAM-PLASMA DISCHARGE
Yu. G. Zalesskii and N. I. Nazarov. 1968. 10 p refs. In RUSSIAN; ENGLISH summary.
(NP-17945) Avail: AEC Depository Libraries

The mechanism of resonance heating of electrons in a beam-plasma discharge, previously described by Y. G. Zalesskii et al., may be explained by the excitation taking place in a system of electron-cyclotron waves following damping in the plasma. The frequency of electron-beam wave excitation was determined by the magnetic field geometry at the point of beam entrance into the system.
Author (NSA)

N69-41219# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Institut.
INTERACTIONS OF TWO PLASMA CLUSTERS IN THE MAGNETIC FIELD OF THE DIVERTOR
V. G. Zykov, V. I. Karpukhin, N. I. Rudnev, and V. T. Tolok. 1968.

14 p refs In RUSSIAN
(FTI-166) Avail: AEC Depository Libraries

Experiments performed with plasma injections from two coaxial sources through a magnetic-gap divertor are discussed. Studies were made of the chargedparticle cpature inside the divertor aperture. It was found that, during injection simultaneously from two sources, the total number of particles captured is considerably smaller than the total number of particles captured during injection from each source separately. The reduced particle capture during injection from two sources was caused by polarization during interactions of plasma flows transverse to the magnetic field, forming a hollow cylinder in the divertor surface region. Author (NSA)

N69-41220# Akademiya Nauk URSR, Kharkov. Fiziko-Teknicheski Institut.
INTERACTION OF A PLASMA BEAM WITH A PLASMA CYLINDER IN THE MAGNETIC FIELD OF A DIVERTOR
V. G. Zykov, V. I. Karpukhin, N. I. Rudnev, and V. T. Tolok 1968 13 p refs In RUSSIAN
(FTI-167) Avail: AEC Depository Libraries

Penetration of plasma beams (moving across the magnetic field of a divertor) into the hollow cylinder formed near the divertor surface as a result of plasma injection, was studied by means of electric probes, a plasmascope, and a Thomson mass spectrograph. It was found that the front part of the plasma beam penetrated inside the divertor aperture; the tail part stayed on the periphery due to polarization from interaction with the plasma cylinder. Author (NSA)

N69-41224# Sydney Univ. (Australia). School of Physics.
SPECTRAL AND MICROWAVE STUDIES OF THE DECAY OF A HIGHLY IONIZED HYDROGEN PLASMA
G. F. Brand, N. R. Heckenberg, and C. N. Watson-Munro Jan. 1969 22 p refs
(NP-17950; ER-42) Avail: AEC Depository Libraries

The decay of a close to fully-ionized hydrogen plasma immersed in a magnetic field of 1 tesla was investigated spectroscopically and with microwave interferometers at 35 and 120 GHz. It has been found that the plasma decays approximately exponentially in time and that the density-temperature relations in the contracting central column are adequately described in terms of the theoretical predictions of Bates, Kingston, and McWhirter down to densities of about $1 \times 10^{19} m^{-3}$ and temperatures of 2000°K. Competing processes of axial and transverse diffusion have been shown to play no significant part in the decay of this plasma. NSA

N69-41225# Gosudarstvenni Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.
STUDY OF COLLISIONLESS SHOCK WAVES IN A MAGNETIZED PLASMA [ISSLEDOVANIE BESSTOLKNOVITELNYKH UDARNYKH VOLN V ZAMAGNICHENNOI PLAZME]
S. P. Zagorodnikov, G. E. Smolkin, E. A. Striganova, and G. V. Sholin 1968 32 p refs In RUSSIAN
(IAE-1646) Avail: AEC Depository Libraries

The structure of the front and nature of propagation of direct collisionless shock waves in a plasma in dependence on the Alfven - Mach number, M_A, is discussed. The jump in the electron temperature at the wave's front is measured spectroscopically. The results are interpreted on the basis of the turbulent dissipation mechanism. At an increase in the M_A number, there occurs a specifically irreversible process evidently associated with the increase in the effectiveness of the conversion of the magnetic piston energy to the ions' kinetic energy. NSA

N69-41238# Gosudarstvennyi Komitet Po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.
HIGH FREQUENCY STABILIZATION OF POTENTIAL PERTURBATIONS IN PLASMA
L. L. Artsimovich, A. A. Ivanov, A. N. Lukyanchuk, V. D. Rusanov, S. S. Sobolev et al 1968 16 p refs In RUSSIAN
(IAE-1657) Avail: AEC Depository Libraries

The stabilization of potential oscillations in a plasma by a high-frequency azimuthal magnetic field was studied. The experiments were run on a Q machine and in the positive column of a gas discharge. NSA

N69-41290# Academy of Sciences, Moscow (USSR). Inst. of Physics.
THEORY OF EQUILIBRIUM AND STABILITY OF HIGH-CURRENT, SELF-CONSTRICTING DISCHARGES IN A DENSE OPTICALLY TRANSPARENT FINITE-CONDUCTIVITY PLASMA
A. A. Rukhadze and S. A. Triger 1969 46 p refs In RUSSIAN
Its Preprint No. 26
AEC Depository Libraries

The work is a continuation of the studies previously reported. Theoretical data on equilibrium and stability of a high-current self-constricting optically transparent plasma are evaluated, considering the volume of the emission. Cases of a simple cylindrical discharge (Z pinch) and discharge with a reverse axial current (inverse pinch) were examined. It is shown that a discharge in an optically transparent plasma with a power instability (constriction and buckling) is subjected also to superheated instability. Under the given conditions ($T \approx 3$ to 5 eV, $n \approx 10^{17}$ to 10^{18} cm^{-3}) the instability developed very rapidly. The increment of various types of instabilities was calculated, and discharge parameters satisfying required duration were determined. Author (NSA)

N69-41297# Akademyia Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Institut.
TURBULENT HEATING OF PLASMA IONS DURING THE GROWTH OF ELECTRON - ACOUSTIC INSTABILITY
V. L. Sizonenko and K. N. Stepanov 1968 20 p refs In RUSSIAN; ENGLISH summary
(FTI-218) Avail: AEC Depository Libraries

Studies of weak turbulence in plasma with hot ions and cold electrons revealed that small-scale hf electron - acoustic instabilities developed by ion motion relative to electron motion in the electric field. The motion developed along a circle of low-frequency electromagnetic waves with frequency of the order of the ion cyclotron frequency ω_{Hi}. It is shown that during the span of time $1/\omega_{Hi}$ in the system, rotating along with the wave, a stationary spectrum of electron - acoustic pulsations appeared, with a sharp maximum in the space of wave vectors k that exceeded the level of thermal noises by several orders of magnitude. Ion scattering by electron - acoustic oscillations resulted in increases, transverse in relation to the external magnetic field, of the thermal energy of the ions. Expressions are derived for the spectral intensity of electron - acoustic fluctuations, taking into account their nonlinear self-interactions, and a quasi-linear equation was developed for the background function of ion distribution determining turbulent ion heating. Author (NSA)

N69-41300# Stanford Univ., Calif. Mechanical Engineering Dept.
HEAT TRANSFER FROM A PLASMA IN TUBE FLOW
Philip S. Schmidt Sep. 1968 p 185 refs
(Contract AT(04-3)-247)
(SU-247-14) Avail: CFSTI

Heat transfer from a stream of partially ionized argon flowing in a water-cooled circular tube, 1/2 inch in diameter was investigated. Experiments were run with initial mixed-mean temperatures up to 21,000°R, at Reynolds numbers from 140 to 527 based on equilibrium properties evaluated at the entrance mixed mean temperature. Measured plasma flow Nusselt numbers

computed on an enthalpy basis, $N_{Nu,h} = [qD/(k/c_p)_m (h_m - h_w)]$ were found to correlate well with low temperature constant property results in the region beyond 5 to 10 diameters downstream of the tube entrance; in the upstream region, Nusselt numbers were about 30% higher than constant property entrance region predictions. This tendency of the data to rapidly approach the constant property solution was predicted by the laminar finite-difference analysis for plasma tube flow. Author (NSA)

N69-41342# New Mexico Univ., Albuquerque. Nuclear Engineering Dept.
THEORETICAL INVESTIGATION OF MOMENTUM AND ENERGY TRANSFER FREQUENCIES IN TWO TEMPERATURE PLASMAS
W. F. Walters and W. L. Everett 1969 9 p refs Held at the 9th Intern. Conf. on Phenomena in Ionized Gases, Bucharest, Romania Sponsored by Sandia Labs.
(SC-CR-69-3173; CONF-690803-3) Avail: CFSTI

The test-particle method of computing momentum and energy transfer frequencies is discussed. Using the Lenard – Balescu kinetic equation to represent particle interactions the test particle method is employed to compute like-particle and unlike-particle energy and momentum transfer frequencies over the range of T_e/T_i from 1 to 100. NSA

N69-41386# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Institut.
INVESTIGATION OF THE GROWTH OF AZIMUTHAL CURRENT AND MICROWAVE RADIATION OF A THETA – PINCH PLASMA
I. Yu. Adamov, V. D. Berezhnyi, L. A. Dushin, and V. I. Kononenko 1968 17 p refs In RUSSIAN
(NP-17943) Avail: AEC Depository Libraries

Plasma radiation was studied at initial pressure of 10^{-2} to 10^{-1} mm Hg, using an extrasensitive superheterodyne receiver operating at wave lengths of 3.2 cm and 8 mm. The azimuthal current growth of a theta – pinch plasma was investigated by means of the Rogowski loop and a two-loop compensating magnetic probe and correlated with the simultaneous microwave emission. NSA

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N69-40001# Arizona State Univ., Tempe. Dept. of Chemistry.
DIFFUSION IN OXIDES AND SULFIDES
M. O'Keefe 1968 42 p refs
(Grant AF-AFOSR-719-65)
(AD-691163, AFOSR-69-1853TR) Avail: CFSTI CSCL 20/12

Diffusion data for oxides and sulfides are reviewed and compiled. The thermodynamic parameters characterizing diffusion are discussed. The information yielded by interdiffusion experiments is discussed. Author (TAB)

N69-40027*# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
A FLOATING ZONE TECHNIQUE FOR THE GROWTH OF CARBIDE SINGLE CRYSTALS
Walter Precht and Graham E. Hollox May 1968 21 p refs Presented at Intern. Conf. on Crystal Growth Birmingham, Engl., Jul. 1968 Submitted for publication
(Contracts NASw-1290; DA-31-124-ARO/D/467) (NASA-CR-106334; TR-2; TR-6; Rept-68-9-C) Avail: CFSTI CSCL 20B

Single crystals of pure and alloyed carbides of different carbon-to-metal ratio have been prepared using a floating zone technique. This paper discusses application of this technique specifically to the growth of VC single crystals. Longitudinal variations in composition from about $VC_{0.82}$ to $VC_{0.75}$ are observed when a rod of initial uniform composition $VC_{0.75}$ is zone refined. Variations in composition from about $VC_{0.85}$ to $VC_{0.88}$ are produced in rods initially of composition $VC_{0.88}$. However, since $VC_{0.83}$ is close to the melting point maximum in the VC phase, little variation in composition is observed on zone refining. These variations in composition are as expected from considerations of the phase diagram and the principles of zone refining. The production of rods of constant composition utilizing the principles of zone levelling is discussed. Author

N69-40051# Naval Research Lab., Washington, D.C.
FRACTURE MECHANICS AS RELATED TO THE NEUBER STRESS CONCENTRATION FACTOR AND PLASTIC PARTICLE
J. A. Kies and H. L. Smith Jun. 1969 12 p refs
(AD-690867; NRL-6903) Avail: CFSTI CSCL 20/12

A proposed relation between the Irwin stress intensity factor K and the Neuber stress concentration factor was examined to show the degree of its realism and applicability. Realistic limits to the stress sigma max and the radius of curvature of the notch rho were stated for that relation. Author (TAB)

N69-40056*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IONIC CONDUCTIVITY OF LANTHANUM FLUORIDE
William L. Fielder Washington Oct. 1969 16 p refs
(NASA-TN-D-5505) Avail: CFSTI CSCL 20B

The electrical conductivities of lanthanum fluoride single crystals containing from 0.02 to 0.15 mole percent calcium ion impurities were measured between 25° and 740° C. The activation energies for the formation of Schottky defects and for the migration of fluoride ion vacancies are 46 and 7.6 kcal/mole (192 and 32 kJ/mole) respectively. Mechanisms are proposed for the fluoride ion conduction process in lanthanum fluoride. Author

N69-40093 National Lending Library for Science and Technology, Boston Spa (England).
ACCURACY OF DIFFUSION OPERATIONS
Jirhi Balash 18 Jul. 1969 13 p refs Transl. into ENGLISH from Slaboproudy Obzor (Prague), v. 29, no. 10/11, 1968 p 585 – 589
(NLL-PORS-Trans-2579-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The influence of parameters on the resulting depth of penetration caused by diffusion of impurities in silicon is analyzed. Two cases are discussed: diffusion under constant conditions and diffusion of constant quantities. The influence of temperature variations, surface concentration, concentration in the basic material, and diffusion time are considered in detail. The results correlate favorably with practical experience. Author

N69-40096# University of Southern Calif., Los Angeles. School of Engineering.
ELECTRONIC SCIENCES LABORATORY Consolidated Semiannual Progress Report, 1 Oct. 1968 – 31 Mar. 1969
Apr. 1969 288 p refs
(Grants AF-AFOSR-1622-69)
(AD-690868; SAPR-9) Avail: CFSTI CSCL 20/12

Contents: Semiconductors; Quantum electronics and lasers; Magnetism; Defects in crystals; Metals; Plasmas; Millimeter wave

radiometry; Control systems; Communication and radar systems; Switching, automata theory, and computers; Biomedical engineering; and Biomedical mathematics. TAB

N69-40097# Polytechnic Inst. of Brooklyn, N.Y. Electrical Engineering Dept.
ELECTRONIC ENERGY BANDS IN SOLIDS Final Report, 1 Feb. 1965 - 30 Sep. 1968
Herbert Schlosser Jul. 1969 7 p refs
(Contract DA-31-124-ARO-D-307)
(AD-690869; Rept-5302.1-E) Avail: CFSTI CSCL 20/12

An investigation of a number of different aspects of the electronic properties of solids is described. The work involved determination of the one electron energies and electron wave functions in a prescribed crystal potential. The main technique used was the composite wave variational method. Research fell into three categories: calculation of physical quantities depending upon knowledge of crystal wave functions; energy band theory and calculations; and molecular theory. Author (TAB)

N69-40172# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH
Peter E. Tannenwald 1969 58 p refs
(Contract AF 19(628)-5167)
(AD-690997; ESD-TR-69-110) Avail: CFSTI CSCL 20/12

The report covers in detail the solid state research work at Lincoln Laboratory for the period 1 February through 30 April 1969. The topics covered are Solid State Device Research, Materials Research, and Physics of Solids. The work formerly reported by the Optics and Infrared Group will henceforth appear in a separate report entitled Optics Research to be issued by the Optics Division. Author (TAB)

N69-40196*# Radio Corp. of America, Harrison, N.J. Electronic Components.
SUPERCONDUCTIVE 7.2-TESLA FOUR-MAGNET ASSEMBLY Summary Report
E. R. Schrader and R. Del Grosso Washington NASA Oct. 1969 77 p refs
(Contract NAS3-7928)
(NASA-CR-1474) Avail: CFSTI CSCL 20K

The design, fabrication, and testing of a system, consisting of four magnets and a Dewar, that develops 7.2 Teslas in a 50.8 cm diameter bore is described. The design of these magnets was based upon the use of niobium stannide (Nb_3Sn) superconductive ribbon wound in layer form with associated techniques that had proved successful in many previously constructed high-field magnets. Modular construction was used to contain mechanically the large forces that develop and to facilitate winding, powering, and testing of subgroups of coils. Specific superconductors were designed for use in local regions of the magnet to allow for differing requirements of current-carrying capacity at the field ranges and for varying hoop stresses. The combined use of these concepts culminated in the superconductive magnet described. Author

N69-40250# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE NATURE OF INDUCED ANISOTROPY
A. G. Lesnik et al 4 Feb. 1969 12 p refs Transl. into ENGLISH from Akad. Nauk Ukr. RSR, Struktura i Svoystva Metallicheskikh Plenok (Kiev), 1966 p 26 - 39
(Contract F33657-68-D-0866/P002)
(AD-692184; FTD-HT-23-614-68) Avail: CFSTI CSCL 20/12

Current literature on magnetic anisotropy induced in ferromagnetic films during deposition is reviewed. The effects on anisotropy of thermal anneals, defects, impurity atoms, and mechanical stresses are considered. On the basis of the data on the kinetics of the processes occurring during the annealing one can draw the following conclusion. Base temperatures of about 100 degrees C are special in the sense that below and above this temperature the kinetics of the processes are accelerated. Possibly the phenomenon below 100 degrees C is in part related to some decrease in activation energy of the processes in connection with an increase in stress in the film with a decrease in base temperature. This assumption seems entirely valid, since with a decrease in base temperature the total number of point defects and the relative fraction of unordered vacancies increases. The reasons for the acceleration of the kinetics of the processes in films obtained at a temperature above 100 degrees C are still not clear. It is noted that there is much interest in studying the effects of impurities and rate of deposition on the kinetics of the formation of anisotropy. Author (TAB)

N69-40357*# Techtran Corp., Glen Burnie, Md.
PRODUCTION AND PROPERTIES OF RARE EARTH METAL MONOCRYSTALS [POLUCHENIYEI I SVOYSTVA MONOKRISTALLOV REDKOZEMELNYKH METALLOV]
Ye. M. Savitskiy et al Washington NASA Oct. 1969 9 p refs Transl. into ENGLISH from Rost Kristallov (Moscow), v. 6, 1965, p 301 - 307
(Contract NASw-1695)
(NASA-TT-F-12632) Avail: CFSTI CSCL 20B

The authors develop a method and apparatus for the purification and growing of monocrystals of the rare earth metals. The growth method consists of purification of the metals by vacuum distallation, vacuum remelting of the distillate with directed crystallization and recrystallization annealing in a high vacuum. The method is used to produce monocrystals of scandium, yttrium, gadolinium and neodymium up to 8 × 10 × 12 mm. Some of the physical constants and anisotropy of mechanical, electrical and magnetic properties of these crystals in the various crystallographic planes are determined. Author

N69-40383*# North American Rockwell Corp., Anaheim, Calif. Physical Sciences Dept. of Autonetics.
HETEROEPITAXY OF 3-5 COMPOUND SEMICONDUCTORS ON INSULATING SUBSTRATES Interim Report
Harold M. Manasevit and Arthur C. Thorsen May 1969 69 p refs
(Contract NAS12-2010)
(NASA-CR-86258) Avail: CFSTI CSCL 20B

Thick ($>15\mu m$) undoped GaAs films with room temperature mobilities between 5000 and 6000 cm^2/V-sec for carrier concentrations in the range from $\approx 10^{16}$ to $\approx 10^{17}$ cm^{-3} were grown on (0001) Al_2O_3 by the trimethylgallium (TMG)-arsine (AsH_3) process over the temperature range 650° to 700°C. The carrier concentrations of the resulting films are found to depend primarily on the purity of the starting materials and carrier gases. Depending on the source of AsH_3 and TMG, net impurity concentrations in the films may range from $\approx 10^{15}$ to over 10^{17} cm^{-3}. Good quality films can be obtained by using either H_2 or He as a carrier gas. Film quality depends greatly on the relative AsH_3-TMG concentrations. By manipulation of this ratio it is possible to control the carrier concentration, resistivity, and conductivity of the resulting films. The first few microns of growth of an internally undoped GaAs film were generally p-type. With subsequent growth the sample reverts to n-type, with a continuing improvement in film quality. Nucleation studies of the growth of very thin ($\leq 1\mu m$) films of GaAs have shown that the early stages of growth involve formations of small islands with pyramidal structure. $GaAs/Al_2O_3$ orientation relationships showed a preference for (111) GaAs growth, with pronounced twinning being the rule rather than the exception. Author

N69-40612# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
NONUNIFORM FIELD DISTRIBUTION IN AVALANCHING InSb CRYSTALS
Bengt Andersson and Peter Weissglas. Griffiss AFB, N.Y. RADC 29 May 1969 34 p refs
(Contract F61052-69-C-0001)
(AD-691839; RADC-TR-69-274; SR-1) Avail: CFSTI CSCL 20/12

The electric field distribution and current-voltage characteristic in the avalanche region is calculated for InSb crystals of both n- and p-type. It is shown that when the transit time is short compared to the carrier lifetime space charge effects make the field distribution highly nonuniform. A current controlled negative differential resistance may also develop due to the same effects. Author (TAB)

N69-40619# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
CHARACTERISTICS OF AVALANCHE DISCHARGE CHANNELS IN SILICON p-n LAYERS [EIGENSCHAFTEN VON LAWINENENTLADUNGSKANAELEN IN SILIZIUM-PN-SCHICHTEN]
Helmut Bernt (Ph.D. Thesis) [1968] 30 p refs In GERMAN
Avail: CFSTI

The theory and some fabrication techniques for diodes operating near the breakthrough voltage are discussed and compared with the properties of Geiger-Mueller counters. A geometric model of the p-n transition is used to calculate the electrical characteristics of nonplanar alloyed diodes. Special attention is paid to the technological parameters affecting the radiation sensitivity of the solid-state counters. The dark-impulse rate, internal resistance, charge carrier motion, and drift rates are examined. Transl. by K.W.

N69-40738# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
COMPUTER PROGRAM FOR INDEXING CRYSTALS FROM THEIR X-RAY POWDER PATTERNS
Clinton R. Heiple. 28 Mar. 1969 93 p
(Contract AT(29-1)-1106)
(RFP-1292) Avail: CFSTI

INDEX is a computer program written in Fortran IV-G which indexes materials on the basis of their X-ray powder patterns. The program can be run on the IBM 360/40. Crystals belonging to the cubic, hexagonal, tetragonal, and orthorhombic classes can be indexed by supplying the 2θ reflections, where θ is the Bragg angle. Author (NSA)

N69-40871# Harvard Univ., Cambridge, Mass. Engineering and Applied Physics Div.
SPECIFIC HEAT AND HEAT OF CRYSTALLIZATION OF AMORPHOUS GERMANIUM
H. S. Chen and D. Turnbull. May 1969 13 p refs
(Contract N00014-67-A-0298-0009; ARPA-SD-88)
(AD-691388; TR-22) Avail: CFSTI CSCL 20/12

The specific heat and heat of crystallization of vapor- and electro-deposited amorphous germanium were measured with a differential scanning calorimeter. The excess specific heat of the amorphous germanium over that of crystalline phase increased linearly with temperature over the temperature range from 215 to 460K. The heat of crystallization of the amorphous films was found to be about 2.75 k cal/gm-atom. The interpretation of the results in terms of the structure is discussed. The specific heat of crystalline germanium was also measured for the temperature range from 215 to 700K. Author (TAB)

N69-41091# Stanford Univ., Calif. Solid State Electronics Lab.
MEASUREMENT OF THE NEGATIVE DIFFERENTIAL MOBILITY IN GALLIUM ARSENIDE AND GERMANIUM
Dick M. Chang. Jun. 1969 111 p refs
(Contract NONR-225(83))
(AD-691440; SU-SEL-69-024; TR-5008-1) Avail: CFSTI CSCL 20/12

The dependence of the drift velocity of electrons on the electric field (v-E characteristics) in GaAs at room temperature and Ge at low temperatures (below 78 degrees K) were investigated. The primary object of these investigations is the establishment and characterization of negative differential mobility regions in the v-E characteristics. Author (TAB)

N69-41118# Joint Publications Research Service, Washington, D.C.
HIGH-TEMPERATURE SUPERCONDUCTIVITY PROBLEMS
V. L. Ginzburg. 15 Oct. 1969 16 p refs Transl. into ENGLISH from Priroda (Moscow), no. 7, Jul. 1969 p 11-17
(JPRS-49060) Avail: CFSTI CSCL 20L

The nature of high temperature superconductors and the causes of its limited technological applications are discussed. The basic problem is the fact that thermal motion in a metal, increasing with temperature, breaks up the electron pairs which characterize superconductivity. As a result, at temperatures above the critical point, the superconductor acts like a normal metal. Possible methods for overcoming the difficulties in creating high temperature superconductors are briefly mentioned. The theory behind such techniques involves using other than phononic interaction mechanisms for generating the basic electron attractions. A.C.R.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N69-40046*# TRW Systems Group, Redondo Beach, Calif. Science and Technology Div.
SPACE STORABLE THRUSTER INVESTIGATION Final Report, Jul. 1967 - Nov. 1968
F. E. Arndt and R. M. Williams. 1 Aug. 1969 341 p refs
(Contract NAS3-11184)
(NASA-CR-72495; TRW-09588-6003-R0-00) Avail: CFSTI CSCL 21I

An analytical and experimental program was conducted with the objective of evaluating cooling techniques for space storable reaction control thrusters using the various FLOX/LPG propellant combinations. Also performed was a detailed examination of the performance characteristics of each propellant combination. Experimental studies were limited to an evaluation of the feasibility for using the LPG fuel, methane-ethane blend, for film conduction cooling. Author

N69-40178 Rohm and Haas Co., Huntsville, Ala. Redstone Research Labs.
ACCIDENTAL IGNITION IN PROPELLANT PROCESSING
H. M. Shuey. *In* AGARD Advan. in Tactical Rocket Propulsion Aug. 1968 p 13-18 (See N69-40176 24-28)
Copyright. Avail: Issuing Activity

Sources of ignition during solid propellant processing are discussed in terms of the operations performed and the resultant hazard to facilities and personnel. The most serious ignition hazard in composite solid propellant processing occurs during the mixing

operation where the sources for ignition are greatest and the result of an ignition most catastrophic because of the state of subdivision of flammable material and its confinement. Author

N69-40180 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ANALYTICAL AND EXPERIMENTAL STUDIES OF THE STEADY STATE COMBUSTION MECHANISM OF SOLID PROPELLANTS
M. Barrere and F. A. Williams *In* AGARD Advan. in Tactical Rocket Propulsion Aug. 1968 p 49-137 Prepared jointly by ONERA and Calif. Univ., La Jolla (See N69-40176 24-28)
(Grant AF-AFOSR-927-65)

Our present state of understanding of the steady-state combustion mechanisms of solid propellants is reviewed. Attention is focused principally on heterogeneous propellants. Both experimental and theoretical work is discussed. The recent advances considered include studies of linear pyrolysis of propellant constituents, deflagration of exothermic oxidizers, combustion of oxidizer spheres in gaseous fuels, porous-bed combustion, reactions between gaseous fuel and gaseous oxidizer components, metal combustion, propellant strand burning, rocket motor combustion and microcinematographic experimentation. A theoretical analysis of a model of homogeneous propellant combustion is outlined in detail, with special emphasis placed on surface gasification laws and on flammability limits in nonadiabatic systems. Low pressure, moderate pressure, plateau and high pressure domains of combustion are identified for ammonium perchlorate composite propellants. It is concluded that a better foundation for investigating composite propellant combustion properties is available for ammonium perchlorate than for any other oxidizer. Avenues for potentially fruitful future research are recommended. Author

N69-40181 Naval Ordnance Test Station, China Lake, Calif. Research Dept.
REVIEW OF THE COMBUSTION INSTABILITY CHARACTERISTICS OF SOLID PROPELLANTS
E. W. Price *In* AGARD Advan. in Tactical Rocket Propulsion Aug. 1968 p 139-194 refs (See N69-40176 23-28)
Copyright. Avail: Issuing Activity

Classes of instability behavior are reviewed and related to theory and to aspects of the combustion process. Experimental methods for small-scale testing of stability characteristics of propellants are described and typical results are presented. Author

N69-40364# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aero Propulsion Lab.
AN EVALUATION OF THE EFFECTIVENESS OF A STATIC DISSIPATOR FUEL ADDITIVE AFTER TRANSPORT IN A FULL SCALE FUEL DISTRIBUTION SYSTEM Technical Report, Jan.-Aug. 1968
Howard F. Jones and Eddie French May 1969 19 p
(AD-691804; AFAPL-TR-69-23) Avail: CFSTI CSCL 21/4

A test program was performed to determine the feasibility of blending a proven static dissipator additive into a fuel at a refinery, and transferring the product through a long distribution system to the using activity. Test data obtained during the 8 months of the test program show that the conductivity of the fuel decreases to an unacceptable level from refinery to using activity, specific models of fuel quantity probes are adversely affected, and some types of corrosion inhibitors influence the fuel conductivity when used in combination with static dissipator additive ASA-3. Author (TAB)

N69-40518# Boeing Co., Renton, Wash. Commercial Airplane Div.
A TECHNIQUE TO EVALUATE FUEL TANK VAPOR SPACE CONCENTRATIONS AND AN APPLICATION TO ANALYSIS OF FUEL TANK VULNERABILITY: TEM-236
R. J. Schilling 1969 108 p refs
(AD-690792; D6-58392TN) Avail: CFSTI CSCL 13/4

A technique to analyze vapor space concentration transients throughout an aircraft wing fuel tank is described. The analysis considers the vertical diffusion of fuel vapor and the horizontal flow produced by venting. A computer program that utilizes this technique to generate mappings of the vapor space concentrations at selected times is described. The program is used to evaluate the vulnerability of a military aircraft vapor space during a hypothetical mission. Author (TAB)

N69-40782*# Whittaker Corp., San Diego, Calif.
THE DEVELOPMENT OF STRUCTURAL ADHESIVE SYSTEMS SUITABLE FOR USE WITH LIQUID OXYGEN Summary Report, 1 May-5 Dec. 1968
Floyd D. Trischler and Alfred Mc Leod Huntsville, Ala. NASA Marshall Space Flight Center 27 Dec. 1968 56 p
(Contract NAS8-11068)
(NASA-CR-102259; SR-6) Avail: CFSTI CSCL 21I

Quality control tests were developed and utilized to obtain more valid test results from the monomers and prepolymers used on this program. In order to obtain consistent adhesive test results, a standardized bonding procedure was developed. A computer program was devised to evaluate the effect of compositional variables on bond strength. In addition, the effect of surface preparation and the use of primers on adhesive performance was investigated. Processing and scale-up studies were completed on the materials used for this program, with a resultant improvement in yields and batch size of products. The conditions necessary to prepare a storage-stable isocyanate-terminated prepolymer of perfluoropropylene oxide were defined. In addition, a brief study was conducted on amine curing agents for this prepolymer. Various parameters involved in the optimization of the fluorinated polyurethane as an adhesive were investigated. These included the effect of catalyst, catalyst concentration, temperature, filler, and crosslink density. This adhesive was found to be LOX compatible. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N69-40058*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF RADIATION-COOLED MAGNETOPLASMADYNAMIC ARC THRUSTERS
Dennis J. Connolly and Ronald J. Sovie Washington Oct. 1969 12 p refs
(NASA-TM-X-1908) Avail: CFSTI CSCL 21E

Results are given for performance tests on three different radiation-cooled MPD arc thrusters. These are the Avco X-7CR and the McDonnell-Douglas X-4A and X-7. The results are compared to those obtained by the contractors. Author

N69-40076*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPARISON OF EXPERIMENTAL HEAT-TRANSFER COEFFICIENTS IN A NOZZLE WITH ANALYTICAL PREDICTIONS FROM BARTZ'S METHODS FOR VARIOUS

COMBUSTION CHAMBER PRESSURES IN A SOLID PROPELLANT ROCKET MOTOR
Dewey M. Smith (M.S. Thesis—N. C. State Univ.) [1969] 106 p refs
(NASA-TM-X-61900) Avail: CFSTI CSCL 21I

The experimental heat transfer coefficients measured in the nozzle of a small solid propellant motor are compared to the predictions from D. R. Bartz's Nusselt number correlation equation and his technique of solving the boundary layer momentum and energy equations simultaneously for the heat transfer coefficient. Test measurements consisted of temperature responses of five thermocouples mounted on a line perpendicular to the heated surface of the nozzle at each of the measurement locations. The heating rates and the corresponding convective heat transfer coefficients were determined by using the thermocouple data as input to a finite difference heat balance program. The results of the comparisons showed the experimental data from the convergent region and throat to be consistently lower than the predictions made using Bartz's two techniques. It was found that the experimental data in the divergent sections could be correlated by evaluating the skin friction coefficient at the free stream temperature and using it in the simultaneous solution. Author

N69-40078*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF THREE OUTLET-ANNULUS AREA BLOCKAGE CONFIGURATIONS ON THE PERFORMANCE OF A 20-INCH (50.8-CM) AXIAL-FLOW COMPRESSOR ROTOR
Walter M. Osborn and George W. Lewis, Jr. Washington Oct. 1969 24 p refs
(NASA-TN-D-5506) Avail: CFSTI CSCL 01A

An inlet-stage axial-flow rotor was tested with tip annulus flow blockages of 22, 55, and 75 percent inserted downstream of the rotor. All three blockages eliminated rotating stall at speeds as high as 0.7 design and enabled the rotor to be operated under stable conditions to much lower flows than that of the unblocked rotor. Torque values of 83, 64, and 52 percent of the unblocked rotor resulted from blocking 22, 55 and 75 percent of the air flow, respectively, at 0.7 of design speed. The rotor efficiency was adversely affected by the blockages with losses of 22, 38, and 44 percemtage points, respectively, at 0.7 of design speed. Blade temperatures and stresses remained within operational limits. Author

N69-40080*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMBUSTION STABILITY OF SINGLE SWIRL-CAN COMBUSTOR MODULES USING ASTM-A1 LIQUID FUEL
Richard W. Niedzwiecki and Robert E. Jones. Washington Oct. 1969 28 p refs
(NASA-TN-D-5436) Avail: CFSTI CSCL 21B

Swirl-can combustor modules were evaluated in a 6-inch-(15.24-cm-) diameter duct at a pressure of 1 atmosphere, at inlet air temperatures of 100° to 700° F (311 to 644 K), and at airflow rates of 1.0 to 4.8 pounds per second (0.454 to 2.18 kg/sec). Swirl-can combustor modules consisted of a carburetor incorporating a low pressure fuel entry system, a swirler assembly, and a combustor can. Effects of combustor can diameter, module length, swirler assembly type and flow area, and inlet air temperature were determined on combustion stability, combustion efficiency, and flame length. A correlation of combustion stability with swirl-can module parameters was obtained. Author

N69-40138# National Aeronautical Establishment, Ottawa (Ontario). Engine Lab.
GAS TURBINE CYCLE CALCULATIONS: THERMODYNAMIC DATA TABLES FOR AIR AND COMBUSTION PRODUCTS
M. S. Chappell and E. P. Cockshutt. Jan. 1969 117 p refs
(AD-690716; NAE-LR-517) Avail: CFSTI CSCL 21/5

Thermodynamic data tabulations specifically designed for gas turbine cycle calculations are presented for 1 deg intervals from 200K to 2000K, and from 350R to 3600R. The tables are similar to those of Fielding and Topps, but are rather simpler to use, and are available in R deg as well as K deg. Numerical examples illustrating their use are included. The polynomial coefficients used to generate the tabular data are also given, should the user wish to evaluate the properties within a computer program. Author (TAB)

N69-40158# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFICIENCY OF A LOW-ADMISSION SHROUDLESS SUPERSONIC TURBINE STAGE
V. D. Levenberg. 4 Jun. 1969 8 p refs Transl. into ENGLISH from Energomashinostroenie (Moscow), no. 5, 1968 p 40–41
(AD-691668; FTD-HT-23-107-69) Avail: CFSTI CSCL 21/5

Experimental studies of the efficiency of a low-admission shroudless supersonic turbine stage are described. The studies were carried out at three different radial clearances and at a 1.8 mm axial clearance. The study results indicate that the efficiency of a supersonic shroudless turbine stage significantly depends on the radial clearance. The effect of the radial clearance is more pronounced in a supersonic engine than a subsonic one. The effect of the radial clearance on the efficiency of a shroudless stage depends on the admission magnitude. Author (TAB)

N69-40176 Advisory Group for Aerospace Research and Development, Paris (France).
ADVANCES IN TACTICAL ROCKET PROPULSION Conference Proceedings
S. S. Penner ed. (Calif. Univ., La Jolla) Maidenhead, Engl. Technivision Serv. Aug. 1968 489 p refs Mostly in ENGLISH; partly in FRENCH. AGARD Colloq. held at La Jolla, Calif., 22-23 Apr. 1965
(AGARD-CP-1) Copyright. Avail: Issuing Activity

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N69-40177 Rocketdyne, McGregor, Tex. Solid Rocket Div.
PROCESSING AND MANUFACTURE OF COMPOSITE PROPELLANTS
J. F. Tormey *In* AGARD Advan. in Tactical Rocket Propulsion Aug. 1968 p 1-11 (See N69-40176 24-28)
Copyright. Avail: Issuing Activity

This paper is a chemical engineering unit processing treatment of the steps involved in the manufacture of solid propellent motors. The author treats the major processes of raw material preparation, mixing, casting and curing by describing equipment, the processing steps and some engineering considerations associated therewith. The three simultaneous processes occurring within the solid propellant mixing, namely, homogenization, wetting and curing, are discussed in more detail, briefly touching on control of these reactions and the engineering trade-offs among them. Author

N69-40179 Service des Poudres, Paris (France). Laboratoire de Balistique.
INTERIOR BALLISTICS OF POWDER CHARGES [ETUDE DE LA BALISTIQUE INTERIEURE DES FUSEES A POUDRE]
J. Boisson and P. Betin *In* AGARD Advan. in Tactical Rocket Propulsion Aug. 1968 p 19-47 In FRENCH; ENGLISH summary (see N69-40176 24-28)
Copyright. Avail: Issuing Activity

The development of very large size solid rocket engines cannot be accomplished, as in the case of small rocket engines, by empirical methods requring a great number of full-scale firings. It is therefore necessary to predict rocket operation from data obtained on charges of different size and geometry. This paper presents a mathematical method for determining analytically the rocket engine thrust and chamber pressure development curves from the charge and engine geometry, the heat of explosion the kinetics characteristics and any other parameters affecting engine operation. It is shown that it is possible to compute empirical values for burning rate and erosion effects from experimental firings. Following a brief survey of the fundamentals of this method, the procedure is illustrated by four representative examples. Author

N69-40183 Atlantic Research Corp., Alexandria, Va.
ADVANCES IN SOLID-FUEL PROPULSION SYSTEMS FOR TACTICAL ROCKETS
Charles B. Henderson and Robert M. Miller *In* AGARD Advan. In Tactical Rocket Propulsion Aug. 1968 p 249-265 refs (See N69-40176 24-28)
Copyright. Avail: Issuing Activity

The objective of this paper is to present a brief survey of three areas in which advances of solid propulsion have enabled improved design of tactical rockets. The three areas are microwave attenuation, acceleration-combustion interactions, and performance optimization. In each of the three areas, improved understanding has significantly contributed to rocket technology. The problems remaining are far from solved, however, and the three subjects are fruitful areas for fundamental investigations. Author

N69-40184* Princeton Univ., N.J.
FUNDAMENTAL PROBLEMS OF INJECTOR DESIGN
David T. Harrje *In* AGARD Advan. in Tactical Rocket Propulsion Aug. 1968 p 267-289 refs In ENGLISH; Discussion partly in FRENCH (See N69-40176 24-28)
(Contract NASr-217)

The principal control of the combustion within a liquid-propellant rocket thrust chamber is provided by the injector. Only when precise control of the injection process is attained can optimum performance, dynamic stability, heat transfer compatibility and reproducibility be provided. Control must be designed into each step of the injection process with sufficient isolation provided to insure stability. In the design of the injector manifolding, the main desire is to provide mass and mixture ratio regulation across the injector face. The design of the injector orifices must be such that this mass and mixture ratio control is retained through the orifices and imparted to the droplet sprays that are produced. Furthermore, the orifice design must control the size and distribution of the droplets generated so that combustion will be completed within the chamber. Mechanical damping devices are often required to protect the early mixing zone from transverse velocities and associated displacement effects in the chamber. Only when each phase of the injection process is carefully controlled can the design aims be reached. Author

N69-40186 Rocketdyne, Canoga Park, Calif.
SECONDARY NONDESTRUCTIVE INSTABILITY IN MEDIUM SIZE LIQUID FUEL ROCKET ENGINES
R. J. Fontaine, R. S. Levine, and L. P. Combs *In* AGARD Advan. in Tactical Rocket Propulsion Aug. 1968 p 383-419 refs (See N69-40176 24-28)
Copyright. Avail: Issuing Activity

Linearized mathematical models of feed-system-coupled combustion instability are summarized and discussed. Following the derivation of sufficient conditions for stability from the simplest bipropellant model, the complications that are imposed on the model by compressible fluids in the feed system, nonrigid feed system structures, and time-varying combustion processes are considered. A specific case of an instability associated with a nonrigid injector is described; it is shown that the instability was eliminated by the method predicted by the model to be most effective for control. A bibliography lists papers dealing with these kinds of stabilities. Author

N69-40202*# General Dynamics/Convair, San Diego, Calif.
EXPERIMENTS ON MAGNETOPLASMADYNAMIC ENGINES WITH ROTATING CURRENT DISTRIBUTIONS
A. V. Larson Jun. 1969 28 p refs
(Contract NAS1-8028)
(NASA-CR-66803) Avail: CFSTI CSCL 21C

Flow properties within a continuous d.c. magnetoplasmadynamic engine have been investigated by measuring the ion saturation current to a planar Langmuir probe as a function of probe orientation and position. Plasma swirl, its helical pitch, and its degree of azimuthal uniformity are easily identified. Striking differences occur if the thruster has an axisymmetric electric current distribution or a rotating current spoke. The Langmuir probe appears to detect rotating spokes almost as well as do Rogowski coils wrapped around the thruster anode segments. Transition thresholds from the spoke to no-spoke modes, both visibly stable, are observed, as moderate changes of 10 to 20% are made in either arc current, mass flow or magnetic field. Thermal efficiencies are slightly better on the spoke side of the transition threshold. The arc voltage and the average azimuthal plasma flow change little at the onset of the spoke. The arc parameters were 100 to 600 amp, 10 to 40 mg/sec of argon, and bias magnetic fields up to 2700 gauss. Author

N69-40232# Rome Univ. (Italy). Centro Ricerche Aerospaziali.
AN ELECTRIC PROPULSION SYSTEM FOR ACHIEVING A

GEOSTATIONARY ORBIT [UN SISTEMA A PROPULSIONE ELECTTRICA PER LA DI ORBITE GEOSTAZIONARIE]
Carlo Buongiorno Sep. 1968 20 p refs In ITALIAN; ENGLISH summary
(Rept-19) Avail: CFSTI

The present paper deals with a feasibility study for an Ion Propulsion System to be employed in conjunction with a Scout booster launched into a direct Equatorial Orbit from the CRA San Marco Range in order to achieve with a low Thrust Trajectory, a Geostationary Orbit. Using an ion engine with solar electric power generation with a specific impulse of 5 000 sec a payload of 112 Kg can be placed into a Geostationary Orbit. Author

N69-40329*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HELIUM PRESSURIZATION SYSTEMS FOR LIQUID-METHANE FUEL IN SUPERSONIC TRANSPORTS
Joseph D. Eisenberg Washington Oct. 1969 44 p refs
(NASA-TN-D-5519) Avail: CFSTI CSCL 21I

An analytical study was made to determine the possibility of using helium pressurization systems to pressurize the fuel on a methane-fueled supersonic aircraft. Three systems were proposed and investigated, all characterized by zero or minimum loss of helium. These systems are the helium circulation system, the helium rebottled system, and the minimum helium loss system. The effect on payload of the three systems were determined analytically. Results indicate that these systems offer potential solutions to the tankage problem but are exceedingly complex and involve the use of a great number of mechanical devices. Author

N69-40386# Army Foreign Science and Technology Center, Washington, D.C.
FUEL PUMP
V. G. Kislov 16 Jun. 1969 9 p Transl. into ENGLISH from Byull. Izobret. Tovarnykh Znakov (Moscow), no. 10, 1968 p 128
(AD-691314; FSTC-HT-23-278-69) Avail: CFSTI CSCL 13/11

The pump described here is distinguished from the known models in that the levers which act on the regulating valve simultaneously serve as a load on the regulator which simplifies the construction of the pump and increases the sensitivity of regulation. Author (TAB)

N69-40557# Royal Aircraft Establishment, Farnborough (England).
THE PERFORMANCE OF VARIABLE FREQUENCY, ELECTRICALLY DRIVEN AIRCRAFT FUEL BOOSTER PUMPS
R. F. Sims and R. L. A. McKenzie Oct. 1968 23 p ref
(RAE-TR-68262) Avail: CFSTI

The performance of a typical, induction motor driven, aircraft, fuel booster pump designed for use at constant speed with a constant frequency supply has been examined over a frequency range of about 2:1 and it is concluded that such a pump could be used satisfactorily on a variable frequency system. When required for use alternatively as a boost pump and as a jettison pump there would be some increase in weight but this need not be prohibitive, particularly if pole-changing is used on the motor. Author (ESRO)

N69-40740# Army Foreign Science and Technology Center, Washington, D.C.
METHOD OF IMPROVING PICKUP IN INTERNAL COMBUSTION ENGINES
L. N. Epshteyn 16 Jun. 1969 6 p Transl. into ENGLISH from Izobret. Prom. Obraztsy, Tovarnye Znaki (Moscow), v. 45, no. 14, 1968 Russian Patent no. 216383
(AD-691549; FSTC-HT-23-277-69) Avail: CFSTI CSCL 21/5

The improvement consists in opening the cross sectional area of the nozzle of a turbine compressor at less than its nominal value when the engine is idling, thus keeping the rotor at higher rpm than would normally be the case. Author (TAB)

N69-40754*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PRELIMINARY TESTS OF A GAS TURBINE COMBUSTOR WITH AN AIR ATOMIZING FUEL INJECTOR SYSTEM
James A. Bigelow 7 Oct. 1969 15 p refs
(NASA-TM-X-52688) Avail: CFSTI CSCL 21H

Preliminary tests were made to determine the feasibility of using a simple air atomizing fuel injector in a turbojet combustor. The combustor was one which had been developed previously with swirl atomizing nozzles. A modification was made which allowed the fuel to be injected at low pressures through simple orifices perpendicular to the air stream. The fuel impinged on a flat plate oriented parallel to the air stream and was atomized off the downstream end of the plate. Three different fuel plate designs were studied. Spray patterns using water in place of fuel were inspected visually and photographed. Then the plate that produced the best results was tested with ASTM A1 fuel under burning conditions. The performance was compared to the performance obtained with swirl atomizing nozzles. Combustion efficiencies, uncorrected for duct cooling losses, varied from 86 to 90 percent with both fuel systems. Pressure losses were also the same. The exit temperature radial profile was hotter at the hub for the combustor with the air atomizing fuel system. The preliminary results are encouraging enough to justify further development of the system. Author

N69-40776*# Bell Aerosystems Co., Buffalo, N.Y.
EMPIRICALLY DETERMINED WIND AND SCALE EFFECTS ON HOT GAS RECIRCULATION CHARACTERISTICS OF JET V/STOL AIRCRAFT
Patrick E. Ryan and Wayne J. Cosgrove Washington NASA Oct. 1969 128 p refs
(Contract NAS1-7463)
(NASA-CR-1445; BAC-2099-956005) Avail: CFSTI CSCL 21H

Small scale tests were conducted to investigate the inlet temperature rise (ITR) and hot gas recirculation of three basic configurations representative of jet V/STOL aircraft. Small scale lift jet engine models (approximately 1/16) and a small scale model (0.24) of a NASA jet V/STOL aircraft model were operated at full scale exhaust conditions (1200°F, and exhaust total pressure ratio from 1.7 to 2.0) so as to maintain exhaust momentum similitude. The major test parameters included wind speed and direction, model height above ground, exhaust deflection angle, angle of attack, wing planform to jet exhaust area ratio, and model geometry. Ground winds were found to distort the recirculation of hot gases such as to result in maximum ingestion at approximately 30 fps. Wind direction attenuated ITR as did the presence of wings and exhaust deflection angles. Insight was gained into the structure and distortion of the flow field as affected by wind. Small scale ITR data based on full scale exhaust conditions may be used to reliably assess full scale gross design effects on ITR. Author

N69-40843*# Martin Marietta Corp., Denver, Colo.
STERILIZABLE LIQUID PROPULSION SYSTEM, PART 1 Final Report, 5 Oct. 1966 - 31 Mar. 1968
F. Brady and D. Di Stefano Aug. 1968 231 p refs Prepared for JPL
(Contract NAS7-100; JPL-9S1709)
(NASA-CR-106366; MCR-68-119-PT-1) Avail: CFSTI CSCL 21H

The program involved the exposure of an assembled and fueled bipropellant liquid propulsion system to the ethylene oxide (ETO) and heat sterilization requirements specified. After exposure the system was fired for 280 sec. The program included a design and component selection phase during which the propulsion system design was evolved. A second phase involved the procurement of

components for both a component test series and for assembly into the complete system. The third phase of the program, carried on in parallel with the design phase, was a materials investigation. The fourth phase of the program involved the assembly and test of the complete propulsion system. The components underwent 12 heat sterilization cycles along with functional tests to measure degradation. Corrections or modifications were made as required to allow system testing. Author

N69-40844*# Martin Marietta Corp., Denver, Colo.
STERILIZABLE LIQUID PROPULSION SYSTEM, PART 2 Final Report, 1 Apr. 1968 - 9 May 1969
Samuel C. Lukens. Sep. 1969. 88 p. Prepared for JPL
(Contracts NAS7-100; JPL-951709)
(NASA-CR-106380; MCR-68-119-Pt-2) Avail: CFSTI CSCL 21H

The program was continued to gather additional information resulting from a second series of sterilization exposure cycles and additional materials compatibility tests. Insofar as possible the propulsion system was reassembled to the initial configuration following evaluation of the effects of the initial exposure and test firing. It was then exposed to three-30-hr. dry heat sterilization cycles and refired for an additional 280 sec. The initial portion of the program included a materials testing activity and a components test acitivity wherein early test results could be factored into the design and assembly of the complete propulsion module. Author

N69-40873*# Thiokol Chemical Corp., Denville, N.J. Reaction Motors Div.
OXYGEN DIFLUORIDE/DIBORANE TECHNOLOGY VACUUM IGNITION, PHASE 2 Quarterly Report, 15 Jul. - 14 Oct. 1969
George R. Mistler. 14 Oct. 1969. 33 p. refs
(Contract NAS7-660)
(NASA-CR-106369; RMD-5536-Q3) Avail: CFSTI CSCL 21H

Starting characteristics and potential problem areas in vacuum ignition of space engines using OF_2/diborane and FLOX/diborane propellant combinations are studied by: (1) analyzing physical and chemical mechanisms which control the vacuum ignition of 100-lb thrust rocket engines using the OF_2/diborane propellant combination; (2) determining the effects on engine ignition characteristics when FLOX is substituted for OF_2; and (3) high speed motion photography for engineering evaluation of injection transient and ignition processes. Lead/lag and temperature effects of 22 runs show that hardware and propellant temperatures do not affect the time to main ignition although the character of manifold filling is affected. Runs with OF_2 lead (electrical), produce ignition spikes whereas no spikes are observed in fuel lead runs. Tests with a torque motor operated bipropellant valve in place of the solenoid poppet valve are generally comparable for start-up transient production. G.G.

N69-40884# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
CONCENTRATION OF EFFLUENTS IN A PLUME AS PREDICTED BY A MODEL AND OBSERVED IN FIELD
Gee Tsang. Aug. 1969. 16 p. refs. Supported in part by the Edison Electric Inst. *Its* Fluid Mech. Lab. Publ. No. 69-7
(Grant PHS-AP-00678-01)
Avail: Issuing Activity

Field-measured data of sulphur dioxide and sulphur hexafluoride concentrations in a plume are compared with theoretical predictions based on a plume rise model. The comparison shows that the theoretical model does correctly predict the concentration of pollutants in a plume. The comparison of the concentrations of SO_2 and SF_6, which was an inert gas released to the stacks as a tracer, shows that in the experimental range of 20 miles, the depletion of SO_2 is not an important factor in estimating the rate of dilution. Author

N69-40920# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
ATTITUDE STABILIZATION USING A ROTATING PLUG NOZZLE Final Report, 1 Jan. - 30 Jun. 1969
John E. Draim (Ph.D. Thesis). Jul. 1969. 84 p. refs
(Contract N00014-67-A-0204-0028)
(AD-691852; TR-158) Avail: CFSTI CSCL 19/7

A modified plug nozzle in which the plug is spinning as a gyroscopic mass is investigated. It is postulated that exhaust gas flow is modulated between the plug and the rocket casing in such a manner as to provide a stabilizing moment around the rocket center of gravity, when the rocket longitudinal axis deviates from the plug-spin axis. Lagrange equations of motion are formulated for the dynamical system described by four generalized coordinates. These equations are mechanized in an analog computer to yield plots of rocket angular motions. Critical non-dimensional parameters for the system are identified and discussed. A small demonstrator model was designed, constructed and tested, first with a smooth conical plug, and then with a conical plug having indented turning slots in the area of the exhaust annulus. Tests conducted on the model demonstrated that sufficient gyroscopic rigidity can be generated to counter the unbalanced pressure field effects around the rotating plug. Author (TAB)

N69-40994*# Hughes Research Labs., Malibu, Calif.
LM CATHODE THRUSTER SYSTEM Quarterly Progress Report, 18 Jul. - 4 Oct. 1969
J. Hyman, Jr., J. R. Bayless, D. E. Schnelker, J. W. Ward, and R. L. Seliger. 15 Oct. 1969. 58 p. refs. Prepared for JPL
(Contracts NAS7-100; JPL-952131)
(NASA-CR-106382; QPR-1) Avail: CFSTI CSCL 21I

A 20 cm LM cathode thruster system is being developed for operation at beam currents I_B = 0.5 A to 1.0 A and a beam voltage V_B = 2 kV. Fabrication of the components of the thruster and ground-screen shroud is nearing completion. The thermal design and the thin-screen high-transparency ion-extraction system are similar to those in use with the 30 cm LM cathode thruster developed during the previous phase of this contract. The discharge chamber configuration is derived from that of a 20 cm thruster with an externally cooled LM cathode which is now being optimized for operation in the desired current range. Best performance to date has been achieved at I_B = 790 mA and V_B = 2 kV with a source energy per ion V_S = 290 eV/ion at a mass utilization efficiency η_m = 88%. A lightweight LM cathode has been fabricated, and a feed system is being developed which consists of an electromagnetic pump, a liquid-mercury flowmeter, and a high-voltage isolator. The pump generates a pressure rise of ±0.6 atm with a power expenditure of 2 W, and the flowmeter shows promise of a measurement accuracy of ±1%. All subsystems are enclosed within the ground-screen shroud. The entire system is thermally integrated and rejects discharge heat by radiation alone. Author

N69-41012# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ENGINES OF UNPRECEDENTED SPEEDS
K. A. Gil'zin. 29 Jan. 1969. 317 p. refs. Transl. into ENGLISH of the book "Dvigatelli Nevidannykh Skorostey" Moscow, Izd.-vo Mashgiz., 1965. p. 1 - 331
(AD-691591; FTD-MT-24-303-68) Avail: CFSTI CSCL 21/5

A popularly written coverage is presented of the historical development of jet and rocket engines, covering their beginnings, design developments and problems, competition with and ultimate supersession of the reciprocating engine in flight applications. Final chapters are devoted to discussion of engines of new types. The book concerns the heart of contemporary high-speed aircraft, rockets, and spaceships-different reaction engines. The book covers prospects for development of reaction engines, scientific problems

faced by scientists in this area, and the place of engines of different types in the vast family of reaction engines. Author (TAB)

N69-41016 Purdue Univ., Lafayette, Ind.
EVALUATION OF PERFORMANCE CHARACTERISTICS OF A HIGH CHAMBER PRESSURE OXIDIZER-RICH STAGED COMBUSTION GAS GENERATOR
Robert Leslie Strickler (Ph.D. Thesis) 1968 188 p
Avail: Univ. Microfilms. HC $8.60/Microfilm $3.00 Order No. 69-2984

This thesis describes an experimental investigation of the effects of high stagnation pressures, extremely oxidizer-rich mixture ratios, and various injector configurations on the performance characteristics of a liquid rocket combustor. The experimental combustor consisted of a liquid propellant injector, combustion chamber, combustion chamber extensions, combustion gas mixing ring, and nozzle. Four different injectors, all of the liquid–liquid unlike impingement type, were employed in the investigation to examine the performance dependence on droplet size and injector configuration. Injector configurations were chosen so that performance limiting factors might become readily observable. Evaluation of the prssible dependence of combustor performance on stagnation pressure was made possible by employing different nozzles for specified mass flow ratio and propellant mixture (mass) ratios. Stagnation pressures were varied from 1050 psi to 3650 psi. Dissert. Abstr.

N69-41063*# McDonnell-Douglas Co., St. Louis, Mo.
RADIATION COOLED MPD ARC THRUSTER
D. W. Eskek, J. C. Kkoutil, and R. J. Checkley Jul. 1969 103 p refs
(Contract NAS3-11518)
(NASA-CR-72557; MDC-H296) Avail: CFSTI CSCL 21H

A radiation-cooled magnetoplasmadynamic arc thruster was designed and tested in a power range of 14 to 41 KW and specific impulses between 800 and 3200 sec, using ammonia as the propellant. Thrust performance was obtained for throat diameters from 1.524 to 2.286 cm, magnetic fields from 0.1 to 0.18 tesla, arc currents from 300 to 700 amps, and mass flow rates from 0.020 to 0.040 g/sec. An uninterrupted lifetest was conducted for 508 hours at a nominal power of 32 kW, thrust 57g, and a specific impulse level of 1900 seconds. Author

N69-41234 National Lending Library for Science and Technology, Boston Spa (England).
FURTHER REFLECTIONS ON THE THEORY OF SLIP STREAM PROPULSION
Henrich Focke 1 May 1969 9 p refs Transl. into ENGLISH from Z. Flugwiss (Ger.), v. 15, no. 3, 1967 p 109 - 111
(NLL-T-6232-(5809.95)) Avail: Natl. Lending Library, Boston Spa, Engl., 1 NLL photocopy coupons

A comparison is made of the true performance gains which result by arranging a propulsion device (propeller) behind a stream passing a resistance object (sieve) and by arranging the propeller and sieve side by side (case of the normal propeller). In the case of the normal propeller, total power consumption consists of the mechanical drive and beam performances required for the production of thrust. The sieve first causes a performance reduction from the air through friction heat losses on its wires. The sieve also accelerates the air forward, which is also a performance reduction. R.B.

N69-41283*# Hercules Powder Co., Cumberland, Md. Allegany Ballistics Lab.
NASA ROCKET MOTOR DEFECTS INVESTIGATION. VOLUME 1: TECHNICAL INVESTIGATION Comprehensive Report, Aug. 1966–Jun. 1968
R. B. Enie and C. R. Hitt, Jr. Jun. 1968 93 p refs
(Contract NAS1-6367)
(NASA-CR-66813) Avail: CFSTI CSCL 21H

To reduce the number of glass fiber rocket motors rejected because of various case and/or case-grain interface defects, accept/reject criteria and methods of repair for these defects were developed. The development of repair techniques for application in the field was considered highly desirable. The work consisted mainly of the static firing of 16 X248 rocket motors to evaluate: (1) glass fiber defects in the domes and cylindrical section; (2) repair of glass fiber defects in the cylindrical section; and (3) separations between the propellant and the motor case. Analytical and laboratory work was performed in direct support of the motor program. The program demonstrated that certain glass fiber defects and case bond separations in the X248 motor can be tolerated. A field repair technique for the X248 cylindrical section can be used to repair defects of large magnitude. However, application of these data to accept or reject defects and repairs remains subject to an engineering evaluation of each case. Author

N69-41284*# Hercules Powder Co., Cumberland, Md. Allegany Ballistics Lab.
NASA ROCKET MOTOR DEFECTS INVESTIGATION. VOLUME 2: TABLES AND FIGURES Comprehensive Report, Aug. 1966–Jun. 1968
R. B. Enie and C. R. Hitt, Jr. Jun. 1968 195 p
(Contract NAS1-6367)
(NASA-CR-66814) Avail: CFSTI CSCL 21H

The tables, diagrams, and photographs illustrate material strengths, stress and strain conditions, defects, firing data, and inspection results. This information supports the investigation and findings described in abstract N69-41283. K.W.

N69-41285*# Hercules Powder Co., Cumberland, Md. Allegany Ballistics Lab.
NASA ROCKET MOTOR DEFECTS INVESTIGATION. VOLUME 3: APPENDICES Comprehensive Report, Aug. 1966–Jun. 1968
R. B. Enie and C. R. Hitt, Jr. Jun. 1968 572 p
(Contract NAS1-6367)
(NASA-CR-66815) Avail: CFSTI CSCL 21H

Reports containing the following are presented: (1) radiographic inspection data; (2) repair data for the cylindrical section of Spiralloy motor case gouges; (3) repair data for the propellant-to-case separation; (4) instructions for bonding potting fixture to the X248 motor case; and (5) instructions for pot repair on the motor case. The bulk of the volume consists of graphs containing static firing data for all of the X248 motors. All of this information supports the investigation and findings described in abstract N69-41283. K.W.

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N69-40198*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY OF LOW ENERGY COSMIC RAYS AT 1 AU
James Humphreys Kinsey (Ph.D. Thesis) Sep. 1969 159 p refs
(NASA-TM-X-63710; X-611-69-396) Avail: CFSTI CSCL 04A

The results from the two scintillator ΔE versus $E - \Delta E$ telescopes on IMP-3 and IMP-4 and the solid state telescope on IMP-4 are analyzed and the resulting proton and alpha particle

fluxes presented. A comparison of the quiet time spectra of both protons and alpha particles is made. It is shown that the results after solar minimum in 1965 do not agree with currently accepted theory in the low energy region of the spectrum considered. Further, it is shown that the reason for this may be because of a hysteresis in the particle fluxes with respect to energy. It is found that there is a fairly flat ratio of He^3 to $He^3 + He^4$ in the energy range considered with a value of about 7%. Further evidence is presented for the existence of recurrence events with 27 day periods which are related to large calcium plage regions on the sun and co-rotating regions which produce discrete proton events observed at earth. These observations serve further to establish the source of protons with MeV energies. Author

N69-40254# Joint Publications Research Service, Washington, D.C.

THE EARTH'S RADIATION BELTS

P. V. Vakulov et al. *In its* USSR Achievements in Space Res. (1st Decade in Space, 1957-1967) 24 Jan. 1969 p 112-160 refs (See N69-40251 24-13)

Avail: CFSTI

The current concepts concerning the earth's radiation belts, and the experimental methods used for their study are presented. The methods for registering radiations that are discussed include the gas discharge counter, the scintillation counter, and the semiconductor detector. The inner radiation belt (below 1500 km) and the outer radiation belt are discussed. The distribution of electrons and protons in the radiation belts is analyzed. F.O.S.

N69-40255# Joint Publications Research Service, Washington, D.C.

COSMIC RAYS

P. V. Valulov et al. *In its* USSR Achievements in Space Res. (1st Decade in Space, 1957-1967) 24 Jan. 1969 p 161-187 refs (See N69-40251 24-13)

Avail: CFSTI

The physics of high energy particles, and astrophysics of the solar system are studied by investigating the interactions of particles with ultrahigh energies of the cosmic radiation. The basic results of cosmic ray research conducted in the U.S.S.R. with satellites and space probes are presented. That the earth's magnetic field cannot be regarded as a dipole field is established, and the cosmic ray equator, according to satellite data, is shown in graph form. Variations in cosmic ray intensity during the 11-year activity cycle, and the composition of primary cosmic radiation are discussed. Graphs summarizing the data are included. F.O.S.

N69-40258# Joint Publications Research Service, Washington, D.C.

PLASMA IN INTERPLANETARY SPACE

K. I. Gringauz. *In its* USSR Achievements in Space Res. (1st Decade in Space, 1957-1967) 24 Jan. 1969 refs p 307-333 (See N69-40251 24-13)

Avail: CFSTI

An attempt is made to show how ideas concerning interplanetary plasma developed in connection with experiments made with space vehicles. Concise information is given on the physical characteristics of the plasma and magnetic fields in interplanetary space, and it is shown by data from interplanetary probes that the conclusions drawn by Parker concerning the release of plasmas by the sun, accelerating with distance from the sun, are correct. It is concluded that direct plasma measurements by space vehicles demonstrate the correctness of the dynamic model is interplanetary space which is always filled with streams of ionized gas emanating from the sun. F.O.S.

N69-40259# Joint Publications Research Sercice, Washington, D.C.

STUDIES OF SOLAR SHORT-WAVE RADIATION

S. L. Mandelshtan. *In its* USSR Achieveemnts in Space Res. (1st Decade in Space, 1957-1967) 24 Jan. 1969 p 334-364 refs (See N69-40251 24-13)

Avail: CFSTI

The range of electromagnetic radiations (from 2.5 to 8μ) which is used in radio astronomy is studied by space probes which have gone beyond the earth's atmosphere which absorbs all radiations shorter than 3000 Å. Although this region represents about 1.5 percent of the total solar radiation flux, solar shortwave radiation exerts an influence on the earth's atmosphere by causing dissociation of molecules into atoms, and photochemical reactions, with the formation of new molecules and ionization. The electrons and ions form the earth's ionosphere which influences radio communication. Galactic and extragalactic sources of X-radiation in space have been discovered. Some of these discrete sources emit flux in X-radiation which exceeds the radiation flux in the optical and radio ranges. F.O.S.

N69-40412*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SOLAR ACTIVITY, 27-DAY VARIATION AND LONG TERM MODULATION OF COSMIC RAY INTENSITY

V. K. Balasubrahmanyan and D. Venkatesan. Sep. 1969 9 p refs

(X-611-69-438)

(NASA-TM-X-63715) Avail: CFSTI CSCL 04A

The effect of the double maxima in the 11-year cycle of solar activity was detected both in the long term modulation and the 27-day variation in cosmic ray intensity. A linear relationship between the amplitude of the 27-day variation and the cosmic ray intensity was obtained. The constraints that this observation puts on theories of modulation of cosmic ray intensity are discussed. Author

N69-40778 National Lending Library for Science and Technology, Boston Spa (England).

THE DISTRIBUTION OF 24-HOUR TOTALS OF SOLAR RADIATION OVER SEPARATE HOURLY INTERVALS

S. I. Sivkov. 20 Jul. 1969 12 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 223, 1968 p 125-131

(NLL-M-7712-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

Total solar radiation intensity calculations were used to determine separate hourly totals from established daily totals. Whillier's method supplemented by astronomical data was applied. Using curves of observational data in relation to calculated values of hourly radiation totals, a table of values was derived from which a nomogram was constructed which is applicable in different climatic conditions and independent of geographic position. The accuracy of the table was sufficient for the working up of autographic records, for calculating hourly totals of total radiation and direct radiation of a horizontal surface. Only sunset and sunrise hourly values are over-estimated, and the largest deviation is anticipated for the summer hours near noon. M.H.E.

N69-40811*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

PROPAGATION IN A PLANAR INHOMOGENEOUS PLASMA MEDIUM

John D. Norgard. 1 Nov. 1969 38 p refs

(Contract NAS7-100)

(NASA-CR-106397; JPL-TR-32-1394) Avail: CFSTI CSCL 20I

The theory of wave reflection and refraction in a planar inhomogeneous plasma medium is presented. The first method for determining the reflection and refraction coefficients for various inhomogeneous distributions is to stratify the medium into thin plasma layers, each containing a homogeneous plasma, and satisfy the boundary conditions on the field vectors across each layer. The second method is to examine the change in the reflection and

refraction coefficients as the medium is constructed from one edge to the other by the addition of planar layers of infinitesimal thickness. The reflection and refraction coefficients satisfy Riccati equations, which are solved numerically to yield the desired coefficients. Author

N69-40869# Air Force Cambridge Research Labs., Bedford, Mass. Office of Aerospace Research.
SCATTERING OF HF RADIO WAVES BY A SPHERICAL ELECTRON CLOUD
Milton M. Klein and Richard S. Mabee Jun. 1969 30 p refs
(AD-691428; AFCRL-69-0261; PSRP 384) Avail: CFSTI CSCL 4/1

Numerical and analytic solutions in the ray optics region were obtained for the scattering of HF radio waves by a spherical electron cloud with a Gaussian distribution of electron density in the radial direction. The results show that a highly overdense or hard cloud has a wide range of backscatter angles for which the cross section is almost constant with a value close to that of an equivalent conducting sphere (critical radius size). A slightly overdense or soft sphere has a much narrower range of almost constant cross section whose value is proportional to the fourth power of the critical radius and considerably below that of an equivalent conducting sphere. In the region of forward scatter all spheres have essentially the same cross section independent of hardness. For underdense spheres the cross section is generally the same as that characteristic of forward scattering except in the region of maximum deflection where the cross section increases very sharply. It is found that when an underdense sphere becomes critical the maximum deflection is 90 deg, whereas an overdense sphere retains its maximum deflection of 180 deg at the critical density. For overdense spheres the analytic results are in good agreement with those obtained numerically, but for underdense spheres are not in good agreement at the higher electron densities. Author (TAB)

N69-40925*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ALPHA PARTICLES EMISSIVITY OF THE MOON: AN OBSERVED UPPER LIMIT
Richard S. Yeh and James A. Van Allen Jul. 1969 25 p refs
(Grant NGL-16-001-002; Contract Nonr-1509/061)
(NASA-CR-106452; Rept-69-38) Avail: CFSTI CSCL 03B

By the observations with the moon-orbiting spacecraft Explorer 35 during 1967-1968, it is unlikely that the alpha particle emissivity of the moon is greater than 0.064 (cm^2 sec sr)$^{-1}$ and exceedingly unlikely that it is greater than 0.128, these values being respectively 0.1 and 0.2 of provisional estimates by Kraner et al. in 1966. This result implies that the abundance of $_{92}U^{238}$ in the outer crust (~ a few meters in thickness) of the moon is very much less than that typical of the earth's lithosphere, though it is consistent with the abundance of $_{92}U^{238}$ in terrestrial basalt or in chrondritic meteorites. Author

N69-40949# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESULTS OF SOVIET INVESTIGATIONS OF CHARGED PARTICLES AND MAGNETIC FIELDS IN SPACE
S. N. Vernov et al. 22 May 1969 20 p Transl. into ENGLISH from UN Conf. on the Invest. and Use of Space for Peaceful Purposes, Vienna, 1968
(AD-692150; FTD-MT-24-99-69) Avail: CFSTI CSCL 04/1

The paper sums up the results of Soviet satellite investigations of charged particles and magnetic fields in space during the last 10 years. These are as follows: 1. Discovery of radiation belts around the earth; 2. discovery of a zone of soft electrons beyond these belts; 3. discovery of a plasma sheath extending up to 3-5 earth radii out; 4. experimental confirmation of the existence of solar wind; 5. determination of the form of the earth's magnetosphere and detection of a neutral layer on the night side; 6. confirmation of the absence of a strong lunar magnetic field; 67. investigation of magnetic field and charged particles near Venus and Mars; 8. detection of protons with an energy of 1 MeV filling the solar corpuscular streams in interplanetary space; 9. determination of the intensity of primary cosmic rays; 10. detection of helicity of magnetic lines of force in interplanetary space; 11. detection of electrons in the composition of particles apepearing during chromospheric flares on the sun. Author (TAB)

N69-40950*# Bellcomm, Inc., Washington, D.C.
METHOD FOR ESTIMATING THE ELECTRICAL CONDUCTIVITY OF THE LUNAR INTERIOR
W. R. Sill and J. L. Blank 22 Sep. 1969 36 p refs
(Contract NASw-417)
(NASA-CR-106456; TR-69-103-7-4) Avail: CFSTI CSCL 03B

A theoretical investigation of the lunar interaction with the solar wind and its electric and magnetic fields reveals a method for estimating the electrical conductivity of the lunar interior. Data from a single lunar surface magnetometer, in conjunction with simultaneous measurements of the interplanetary magnetic field and solar wind velocity, should provide sufficient information to distinguish between various classes of conductivity models. Such models are based on different thermal histories and assumed lunar materials. Author

N69-41121*# TRW Systems, Redondo Beach, Calif.
MEASUREMENTS OF PRECIPITATED 1 - 20 keV PROTONS AND ELECTRONS DURING A BREAKUP AURORA
W. Bernstein, G. T. Inouye, N. L. Sanders, and R. L. Wax 27 Jan. 1969 29 p refs
(Contract NASw-1474)
(NASA-CR-106476; TRW-06484-6008-R0-00) Avail: CFSTI CSCL 04A

Measurements of precipitating low energy (1 - 20 keV) protons and electrons during a breakup aurora are described. The observed proton fluxes were as high as 10^8 cm^{-2} sec^{-1} keV^{-1} str^{-1} with an e-fold energy of ≈1 keV; the electron fluxes were ≈10^8 cm^{-2} sec^{-1} keV^{-1} str^{-1} with a spectral peak in the 2 - 4 keV region. During the flight, the rocket passed through the poleward boundary of the auroral form. One interpretation of the data suggests that the proton and >2.5 keV electron precipitation boundaries coincided to within a distance of <1 km; the lower energy electron boundary extended several kilometers poleward of the proton boundary. Evidence for non-isotropic proton fluxes is presented. Author

N69-41128# Air Force Cambridge Research Labs, Bedford, Mass.
COSMIC RAY NEUTRON INTENSITY MONITOR
John A. Simpson (Chicago Univ.) and John A. Lockwood (New Hampshire Univ.) *In its* Geophys. and Space Data Bull., Vol. 6, No. 1 1969 p 13 - 47 refs (See N69-41126 24-13)
Avail: CFSTI

Cosmic ray neutron intensity data are presented for University of Chicago monitoring stations located at Chicago; Climax, Colorado; and Huancayo, Peru. Tabulations from University of New Hampshire stations at Mount Washington and Durham, New Hampshire are also included. The design of the University of Chicago monitor pile was adopted as the standard neutron intensity monitor for both the IGY (July 1957 - Dec. 1958) and the IQSY (1964 - 1965). Short descriptions of the instrumentation and the method of data presentation are included for both Chicago and New Hampshire monitors. A.C.R.

N69-41131# Air Force Cambridge Research Labs., Bedford, Mass.
SOLAR OPTICAL PATROL OBSERVATIONS
Howard L. De Mastus and Alberto Abrami (Trieste Astron. Obs., Italy) *In its* Geophys. and Space Data Bull., Vol. 6, No. 1 1969

p 85 135 refs (See N69-41126 24-13)
Avail: CFSTI

The coding system used in presenting daily observations of solar activity at the Sacramento Peak Observatory, California is described. With the data being directly recorded on punched cards, the necessary reductions can be performed rapidly and completely on an IBM 1620 computer. Codes are described for the following data types: (1) chromospheric flares; (2) flare film record; (3) chromospheric activity other than flares; (4) white-light visual sunspot drawing; (5) spectrographic coronal observations; and (6) sunspot group analysis. A.C.R.

N69-41132# Air Force Cambridge Research Labs., Bedford, Mass.
SOLAR RADIO EMISSION
In its Geophys. and Space Data Bull., vol. 6, no. 1 1969 p 137–297 refs (See N69-41126 24-13)
Avail: CFSTI

Summaries are presented of solar radio bursts recorded in the frequency range 10 MHz to 580 MHZ at the Harvard Radio Astronomy Station. Frequency ranges of the bursts are given in decimeter, meter, and dekameter divisions, implying bursts recorded in the bands 580 to 300, 300 to 30, and 30 to 10 MHz, respectively. Observations of solar radio emission for the range 19 MHz to 41 MHz, as well as radio noise measurements, are also included from the Sagamore Hill Observatory, Massachusetts. The radio noise measurements provide high absolute accuracy flux data at 606 MHZ and 1415 MHz, coverage at other regions in the microwave spectrum with somewhat lesser absolute accuracy, and information on centimeter burst spectra to aid in explaining causative mechanisms. Similar noise tabulations are given from the Oslo Solar Observatory, Norway at 225 MHz and from the Trieste Astronomical Observatory at 239 MHz. Solar patrol data at 8800, 4995, 2695, 1415, and 606 MHz from the Manila Observatory are also presented. Finally, polarization data from solar events observed at Compos do Jordao, Brazil with a 7-GHz radio polarimeter are listed. A.C.R.

N69-41173*# Bellcomm, Inc., Washington, D.C.
AUTOMATIC SPACEBORNE SOLAR FLARE DETECTION
R. K. Agarwal 25 Jul. 1969 95 p refs
(Contract NASw-417)
(NASA-CR-106402; TM-69-1031-2) Avail: CFSTI CSCL 04A

A concept for an automatic spaceborne system that will scan the sun for flares is presented. In this system, the sun would be monitored using a telescope equipped with monochromatic filters (including an $H\alpha$ filter) and an image sensor with broad spectral response. The output of the sensor would be digitized and sent to an onboard digital computer which would extract flare information from each frame. In addition to being sent to the ground, this information could be used to alert the crew when a major flare occurs and to turn on other sensors or cameras for obtaining additional data on the flare. Author

N69-41242 National Lending Library for Science and Technology, Boston Spa (England).
CONDITIONS FOR THE INTENSIFICATION OF MERIDIONAL CIRCULATION IN POLAR LATITUDES
B. I. Sazonov et al [1969] 16 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 227, 1968 p 21–27
(NLL-M-7658-(5824.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

The possibility of high energy protons in cosmic rays carrying disturbances to the lowest layers of the atmosphere is investigated. Indices of disturbance of the atmospheric circulation, representing the intensity of meridional exchange at latitudes 65°, 70°, and 75°N, were calculated for each day of the year over a 17 year period. Monthly averages of disturbance were determined and a seasonal relationship established between the index of geomagnetic activity and the disturbance of the atmospheric circulation for each of the 17 years. The results indicate that the meridional circulation in polar latitudes is mainly determined by the penetration of the earth of high energy protons of galactic origin. The more charged particles enter the polar cap, the more intensely meridional activity develops. Only in summer in years directly after maxima in solar activity is the contribution of high energy particles generated in chromospheric flares on the sun as important as the contribution of high energy galactic protons. D.L.G.

N69-41288# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
ANTIQUARKS IN THE UNIVERSE
A. D. Sakharov 1969 16 p refs In RUSSIAN
(JINR-P2-4267) Avail: AEC Depository Libraries

A hypothesis on the existence of stable electrically neutral antiquarks with an average cosmic density, corresponding to the baryon neutrality of the universe, was suggested. The antiquarks, under this hypothesis, are not captured by nuclei but have noticeable scattering cross section. The existence of particles with the mentioned properties is connected with the hypothesis of the cosmologic CPT symmetry and with the three-triplet quark model. Author (NSA)

N69-41314# Joint Publications Research Service, Washington, D.C.
FIRST JOINT SOVIET BLOC SPACE EXPERIMENTS UNDER WAY
K. B. Serafimov *In its* Transl. on Eastern Europe Sci. Affairs, No. 56 18 Jun. 1969 p1–3 Transl. into ENGLISH from Aviats. i Kosmonavt. (Sofia), Feb. 1969 p 6 (See N69-41313 24-34)
Avail: CFSTI

Fundamental aims of the experimentation and some initial results from the Kosmos-261 satellite launch are briefly summarized. The object of the research program involved measurements of photoelectron movements, magnetoionospheric activity, and various optical phenomena in the upper atmosphere. Investigations of the effect of ionospheric disturbances on radio communications and analysis of ionospheric energy reserves for possible development of aircraft engines based on the neutralization and associative processes were of particular interest. Bulgarian cooperation was evidenced in organization of an extensive network of measuring stations from the Arctic portions of the USSR to the southern Bulgarian border. A.C.R.

N69-41370 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF A HALF-TURN OF THE SUN ON THE TROPOSPHERIC CIRCULATION
B. I. Saznov et al 20 Jul. 1969 19 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 227, 1968 p 110–115
(NLL-M-7714-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

The effect of the influx of high energy protons on the tropospheric circulation is discussed in terms of these particles as effected by solar flares and the intensity of the magnetic fields of corpuscular streams in the cosmos around the earth. It is shown that the earth's magnetic field focuses charged particles of anisotropic flux, and if the proton flux has an increased particle density the flux focused in the earth's magnetic field will be effective in the impact zones resulting in movement of masses of air in the troposphere and affecting the atmospheric circulation. F.O.S.

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N69-40015*# Geological Survey, Washington, D.C.
ASTROGEOLOGIC STUDIES. Annual Progress Report, 1 Jul. 1966 – 1 Oct. 1967
Dec. 1967 74 p refs
(NASA Order R-66)
(NASA-CR-106349) Avail: CFSTI CSCL 03B

Work performed covers the following topics: (1) lunar geologic mapping from both, telescopic and spacecraft photographs supported by photometric studies; (2) field studies of natural structures of impact and volcanic origin and of craters produced by missile impact and explosive devices; (3) laboratory studies of the behavior of rocks and minerals subjected to shock; and (4) studies on chemical, petrographic, and physical properties of tektites, meteorites, and cosmic dust. Techniques of study, analysis, and interpreation of data on materials of known or suspected extraterrestrial origin are described in detail. Author

N69-40048*# Geological Survey, Washington, D.C.
LUNAR CRATER MORPHOLOGY AND RELATIVE AGE DETERMINATION OF LUNAR GEOLOGIC UNITS. PART 1: CLASSIFICATION, PART 2: APPLICATIONS
H. A. Pohn and T. W. Offield Jan. 1969 38 p refs *Its* Astrogeol. No. 13
(NASA Order R-66)
(NASA-CR-106372) Avail: Issuing Activity CSCL 03B

A refined system of age determination of lunar craters is described, using Orbiter 4 photographs with an inferred continuum of morphologic stages. Crater age classification into three classes (>45 km, 20 to 45 km, and 8 to 20 km) based on the planimetric shape of their rim crests is discussed as well as specific features of lunar craters. Erosional modification of the lunar surface and the factors that may contribute to an erroneous assessment of crater ages are reviewed. This system of age determination may be applied to regional geological units and lunar events using the size effect of superposed craters. The numbering system was tested by dating the oldest craters on three regional lunar geologic units. Observations and conclusions about local and moon-wide correlations from the crater numbering system were obtained. J.A.M.

N69-40062*# Michigan Univ., Ann Arbor.
NON-LINEAR LONGITUDINAL DYNAMICS OF AN ORBITAL LIFTING VEHICLE
Nguyen X. Vinh and Arthur J. Dobrzelecki Washington NASA Oct. 1969 38 p refs
(Contract NASr-54(06))
NASA-CR-1449) Avail: CFSTI CSCL 22C

This paper presents an analytical study of the longitudinal dynamics of a thrusting, lifting, orbital vehicle in a nearly circular orbit. The translation motion is composed of a non-linear oscillation, or phugoid, and a spiral mode which results in either decay or dilatation of the orbit depending on the perturbed initial conditions. The non-linear effects on the phugoid period and damping are small in the altitude range considered. Elements of the orbit such as radial distance, velocity, and flight path angle were obtained explicitly as functions of time. The behavior of the variations of these elements is correctly predicted. Explicit expressions for period and damping of the angle-of-attack mode were derived. It is shown that a critical altitude may exist at which the phugoid mode and the angle-of-attack mode have nearly equal periods. Near this resonance altitude linearized solutions are no longer valid and a study of the non-linear equations shows that there is a strong interaction between the translational and the rotational modes resulting in a switching of the two frequencies of oscillations. Author

N69-40090*# Bellcomm, Inc., Washington, D.C.
A MODEL OF THE MARTIAN HAZE
E. N. Shipley 19 Jul. 1969 62 p refs
(Contract NASw-417)
(NASA-CR-106346; TR-69-235-1) Avail: CFSTI CSCL 03B

The pictures of Mars returned to earth by the Mariner 4 spacecraft revealed two anomalies: a bright region extending to at least 150 km above the limb of the planet, and a surprisingly low contrast in the pictures. It is possible that the anomalies arose from an abnormal condition in the spacecraft camera system. A haze model which explains the results of Mariner 4 is presented. The brightness calculations are made on the basis of a first-order scattering theory. The parameters describing the haze cannot be uniquely determined from the data. However, a wide range of parameters provides a reasonable fit to the data. An adopted set of parameters was chosen for further study of the brightness distributions near the planet. The accuracy of the first order scattering approximation was checked by comparing the results to multiple scattering calculations for the specific case of a planar atmosphere. The significance of the haze model lies in the fact that it explains both the brightness above the limb and the low surface contrast with a single model. Author

N69-40113*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE TOPSIDE IONOSPHERE OF VENUS AND ITS INTERACTION WITH THE SOLAR WIND
S. J. Bauer, R. E. Hartle, and J. R. Herman Oct. 1969 10 p refs
(X-615-69-459)
(NASA-TM-X-63717) Avail: CFSTI CSCL 03B

The abrupt termination of the daytime ionosphere of Venus at about 500 km was observed using the Mariner 5 two-frequency occultation experiment for direct solar wind interaction with a planetary ionosphere. A pseudo-magnetopause formed due to the presence of magnetic fields carried along by the solar wind and forced to pile up on the topside of the highly conducting planetary ionosphere was proposed. Solar wind properties were used to calculate order of magnitude estimates of the characterized parameters. A range of possible models satisfying the experimental boundary conditions are being investigated in some detail. Author

N69-40174*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANOMALOUS TEMPORAL BEHAVIOR OF NP0532
Reuven Ramaty and Stephen S. Holt Oct. 1969 10 p refs Submitted for publication
(NASA-TM-X-63716; X-63716) Avail: CFSTI CSCL 03B

Radio and optical bands studies which reveal inconsistencies in measured values of the temporal behavior of NP0532 are examined. Both measurement processes and the physical processes underlying the phenomenon of apparent discontinuities in the average second derivative, as it is indicative of gravitational braking mechanism are considered. Models which hypothesize the nature of apparent discontinuities are discussed in relation to the observed data. It is concluded that none of these fully explain the data, and that the measured values of the second derivative of the period may not reliably indicate the nature of the braking mechanism. M.H.E.

N69-40225# Osservatorio Astronomico di Collurania, Teramo (Italy).
PERIOD CHANGES IN ECLIPSING VARIABLES. PART 1:

PHOTOELECTRIC OBSERVATIONS OF XY LEONIS

P. Tempesti and R. de Carlo Aug. 1968 10 p refs *Its* Note e Comunicazioni 45

Avail: CFSTI

The photoelectric observations of XY Leo performed with the Teramo refractor in the year 1967-68 allow the timing of 7 minima and the determination of a new value of the period. The O-C curve, extended over a 24 year lapse of time, suggest a cyclic variation of the length of the period: the cycle seems to have a length of the order of 10,000 days and its amplitude may be as great as 0.05 d. The O-C curve for the secondary minima coincides with that of the primary minima and therefore the period variations cannot be attributed to apsidal motion. Author (ESRO)

N69-40238# Paris Univ. (France). Laboratoire de Physique de l'Atmosphere.

MEAN DIURNAL VARIATIONS OF THE TOTAL IONOSPHERIC ELECTRON CONTENT [VARIATIONS DIURNES MOYENNES DES CONTENUS TOTAUX D'ELECTRONS DE L'IONOSPHERE]

A. Vassy 1968 91 p ref In FRENCH

(Publ-1968-3) Avail: CFSTI

Mean values of the diurnal variations of the total ionospheric electron content obtained from November 1964 to February 1967 with the aid of ionospheric satellites are shown in a series of graphs grouped over two months and 3° of latitude 39° to 55°N) and magnetic activity index $K \leq 1$ or $K > 1$. Abnormal values were eliminated prior to the analysis. ESRO

N69-40257# Joint Publications Research Service, Washington, D.C.

LUNAR STUDIES

A. A. Mikhaylov et al *In its* USSR Achievements in Space Res. (1st Decade in Space, 1957 - 1967) 24 Jan. 1969 p 274 - 306 refs (See N69-40251 24-13)

Avail: CFSTI

The chronological developments in lunar knowledge are presented with emphasis on the satellite space probes. The problems in the lunar studies program are enumerated, and the plans for their systematic solution are discussed. The achievements of the Luna probes and the Zond interplanatary stations are evaluated. Photographs and topographic maps of the moon surface are included. F.O.S.

N69-40313*# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.

REPORT OF 1967 SUMMER "TYCHO" MEETING

21 Jul. 1967 186 p refs Meeting Held at Hanover, New Hampshire, 20 Jun. - 21 Jul. 1967

(Contract NSR-24-005-047)

(NASA-CR-106301; TG-31) Avail: CFSTI CSCL 03B

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N69-40314*# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.

ON THE RADIO OCCULTATION METHOD FOR STUDYING PLANETARY ATMOSPHERES

D. L. Anderson and R. A. Phinney *In its* Rept. of 1967 "TYCHO" Meeting 21 Jul. 1967 p A1 - A12 refs (See N69-40313 24-30)

Avail: CFSTI CSCL 03B

A direct method of transforming radar Doppler data from an occultation experiment into a profile of refractive index-versus-radius is presented. The technique is useful in interpreting data from planets with a thick atmosphere, where strong bending of the rays is anticipated. Expressions are given for converting radar Doppler data to the index of refraction as a function of depth in the atmosphere and for the effects of geometric spreading and absorption on signal amplitude. A.C.R.

N69-40315*# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.

VARIATIONS IN THE RADAR CROSS SECTION OF VENUS

J. V. Evans *In its* Rept. of 1967 "TYCHO" Meeting 21 Jul. 1967 p C1 - C30 refs (See N69-40313 24-30)

(Contract NSR-24-005-047)

Avail: CFSTI CSCL 03B

Evidence for variations in the cross section are reviewed, and revised values at 3.8 cm are provided. The mean value for the cross section observed in 1966 is now placed at .017. A closer examination of one instance in which the cross section at 3.8 cm was seen to increase reveals that this event was associated with the passage of a large feature through the region of the subradar point. This suggests that the variations observed at this wavelength, like those at longer wavelengths, are associated with the nature of the terrain at the subradar point and are not the result of weather-like phenomena on Venus. Author

N69-40316*# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.

RADAR OBSERVATIONS OF VENUS AND MARS

J. V. Evans *In its* Rept. of 1967 "TYCHO" Meeting 21 Jul. 1967 p D1 - D39 refs (See N69-40313 24-30)

Avail: CFSTI CSCL 03B

The status of recent radar observations of the Planets Venus and Mars is reviewed, and some logical extensions of these investigations to other planetary studies are suggested. Possibly of greatest utility to the space program are the revisions obtained to values for the astronomical unit, the earth - moon mass ratio, the radii of the planets and the elements of their orbits. These enable direction of a deep-space probe to within the immediate vicinity of the planet, where earlier optical data would have been grossly in error. In addition, new values for the rotation periods of Mercury and Venus and estimates of their surface roughness and composition have been obtained. Information concerning the absorption of radio waves by the Venusian atmosphere has also been obtained. The reflectivity and surface elevation versus Martian longitude have been determined for a region in the Martian tropics. These quantities show interesting correlation with visual features. Author

N69-40317*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
REFLECTION AND DIFFRACTION IN A BISTATIC RADAR OCCULTATION EXPERIMENT
T. Hagfors *In* Minnesota Univ. Rept. of 1967 "TYCHO" Meeting 21 Jul. 1967 p E1–E12 ref (See N69-40313 24-30)
(Contract NSR-22-009-106)
Avail: CFSTI CSCL 03B

The strength of the field reflected obliquely from a planet in an occultation experiment is computed for a number of parameters. It is shown that a study of the reflected signal component can provide information about the electrical properties of the planetary surface. Possible distortions of the diffraction pattern caused by surface roughness are also investigated, and it is found that the likelihood of occurrence of surface undulations of observable intensity is very small. Author

N69-40318*# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
WATER VAPOR AND ICE IN THE MARTIAN ATMOSPHERE
H. Heffner *In its* Rept. of 1967 "TYCHO" Meeting 21 Jul. 1967 p F1–F12 refs (See N69-40313 24-30)
Avail: CFSTI CSCL 03B

The infrared measurements of water vapor content in the Martian atmosphere, together with the atmospheric temperatures inferred from the Mariner IV occultation experiment, seem to indicate that the atmosphere is saturated with water vapor. Since winds and clouds have been observed on Mars, it is reasonable to assume that there is considerable vertical mixing in the lower atmosphere. Moreover, the warmer Martian surface will act as a reservoir to maintain a saturated or slightly supersaturated water vapor content in the atmosphere above it. Thus, the model for water vapor content is one in which the lower atmosphere is saturated with water up to a height of some tens of kilometers. In this region, water ice crystals will form whose size is dependent on temperature and height. The existence of these ice crystals can perhaps explain the blue haze, diurnal clearings of haze, the white clouds, blue clearings, and the clouds observed on the limb in the Mariner photographs and in other earth-based photographs. Water ice crystals cannot be invoked to explain the yellow clouds or the polar caps. Author

N69-40319*# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
THE VENUS ATMOSPHERE: FUTURE EXPERIMENTS AND PRESENT KNOWLEDGE
J. J. Hopfield and R. A. Phinney *In its* Rept. of 1967 "TYCHO" Meeting 21 Jul. 1967 p G1–G15 refs (See N69-40313 24-30)
Avail: CFSTI CSCL 03B

A review of present knowledge of the parameters most important to an understanding of Venus stimulates vital questions about the systematics of the lower atmosphere and its interaction with the surface. An atmospheric sounder (or entry probe) is proposed as a logical initial investigation to help satisfy most of these questions. General requirements for sensors and other devices to sample various characteristics of the atmosphere during the probe are included. A series of recommendations concerning the composition, design development, and operation of the proposed entry probe are made to aid planners considering further investigations of the planet. Author

N69-40320*# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
RESONANT AND NONRESONANT SPECTROSCOPY OF VENUS
Benjamin Lax *In its* Rept. of 1967 "TYCHO" Meeting 21 Jul. 1967 p H1–H11 refs (See N69-40313 24-30)
Avail: CFSTI CSCL 03B

Microwave and millimeter radiometer measurements indicate the Venusian surface temperature is about 600°K. In addition, radar measurements give the best value of the dielectric constant at approximately $\epsilon = 5 \pm 1$. More accurate data can be obtained if further measurements with improved equipment are taken in the wavelength region between 3 cm and 30 cm. The nonresonant character of the microwave radiometric data suggests pressure broadening of the emission lines. Infrared data at shorter wavelengths, however, would show a definite resonance; in the range of 1μ to 10μ, the quantitative nature of CO_2, CO, H_2O, and other possible components could be determined from orbiting satellites and from earth-based instruments on high altitude, airborne, or near-satellite vehicles. Author

N69-40321*# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
SOME COMMENTS ON THE SCATTERING OF THERMAL MICROWAVE RADIATION BENEATH A PLANETARY SURFACE
B. G. Smith *In its* Rept. of 1967 "TYCHO" Meeting 21 Jul. 1967 p I1–I16 refs (See N69-40313 24-30)
Avail: CFSTI CSCL 03B

The microwave radiation thermally emitted by a planet originates in the planetary medium and reaches the surface by a process of radiative transfer. A simple model is used to determine the effect on the transfer process of single scattering from centers randomly distributed in the medium. Particular reference is made to the ability of the scattering mechanism to impose a weak linear polarization upon the radiation. It is found that the polarization from scattering is much weaker than that induced by transmission through the surface. As it stands, the model is incapable of providing an explanation of the low value of the surface dielectric constant of the Moon and Venus deduced from measurements of the microwave polarization. The suggestion is made that the development of a multiple scattering model is necessary to provide a complete understanding in the interaction of microwave radiation with a planetary surface. Author

N69-40322*# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
WATER ON MARS
R. Smoluchowski *In its* Rept. of 1967 "Tycho" Meeting 21 Jul. 1967 p J1–J11 refs (See N69-40313 24-30)
Avail: CFSTI CSCL 03B

Water in the form of ice can exist on Mars as permafrost which is either in equilibrium with the water content of the atmosphere or is gradually evaporating through a protective layer of soil. The latter situation is evaluated quantitatively for grains from 0.5μ to 1000μ and for porosities from 0.01 to 0.8. The effective diffusion coefficients are calculated and the required thicknesses of the protective layers estimated. It is concluded that such subsurface ice can exist at Martian latitudes lower than those for which the permafrost is in equilibrium with the atmosphere. This may lead to seasonal variations of radar reflectivity and may explain the higher reflectivity of the dark areas as compared to the bright areas. Author

N69-40325*# TRW Systems Group, Redondo Beach, Calif.
SEQUENTIAL PROCESSING TECHNIQUES FOR TRAJECTORY ESTIMATION
C. G. Pfeiffer, D. D. Morrison, R. E. Mortensen, J. V. Breakwell, W. H. Berry et al. Washington NASA Oct. 1969 135 p refs
(Contract NAS2-4553)
(NASA-CR-1360) Avail: CFSTI CSCL 22C

This report describes the state of the art in sequential processing techniques for trajectory estimation. A major topic discussed is the effect of nonlinearities, with the aim of developing

and justifying practical algorithms for treating the problem. Since nonlinear, maximum likelihood estimation theory has been successfully used in orbit determination for some years, this approach has been emphasized over the more recently suggested nonlinear minimum variance technique. Author

N69-40326*# National Aeronautics and Space Administration, Washington, D.C.
NASA SPACE VEHICLE DESIGN CRITERIA-ENVIRONMENT. METEOROID ENVIRONMENT MODEL–1969 (NEAR EARTH TO LUNAR SURFACE)
B. G. Cour-Palais Mar. 1969 35 p refs
(NASA-SP-8013) Avail: CFSTI CSCL 03C

This monograph treats only the meteoroid environment of cometary origin in the mass range between 10^{-12} and 1 gram at one astronomical unit (1 A.U.) from the Sun near the ecliptic plane. Also included are the lunar ejecta created by the impact of cometary particles on the lunar surface. In this region (1 A.U.) the contribution of asteroidal particles to the total meteoroid population is considered to be negligible. The meteoroid and the lunar surface ejecta flux-mass models and the associated density and velocity characteristics presented herein are for engineering application in the design of space vehicles for near-Earth orbit, cislunar, lunar orbit, and lunar surface missions. Author

N69-40351# Royal Inst. of Tech., Stockholm (Sweden). Plasma Physics Div.
ON THE EQUILIBRIUM OF COSMIC GRAINS
B. Lehnert 16 Aug. 1969 17 p refs
(Rept-69-26) Avail: CFSTI

The balance of matter and heat is investigated for cosmic grains exposed to radiation and surrounded by a plasma or neutral gas. An equilibrium exists only under specific conditions and the grains increase in mass only within certain ranges of density and temperature of the surrounding gas, the radiation intensity and the physical properties of matter. The results are summarized as follows: (i) Grains composed of different elements deviate strongly in their behaviour. (ii) At the present intensity of solar radiation, grains of certain elements should not be present in the interplanetary matter in certain regions of the solar system. (iii) The same grains may have existed at an early stage of the solar system, provided that the radiation intensity of the sun was much smaller than at the present stage. This provides a method of estimating the solar radiation and the gas densities during the development of the solar system. (iv) In the density range applicable to cosmogonical theories, the grains are able to condense under less restrictive conditions in the case of a plasma than in the case of neutral gas. In this respect the difference between the 'hot' plasma and 'cold' neutral gas approaches becomes especially pronounced when the sticking probability of neutral atoms to a grain surface is small. Author (ESRO)

N69-40360*# Geological Survey, Washington, D.C.
FIVE DAY MISSION PLAN TO INVESTIGATE THE GEOLOGY OF THE MARIUS HILLS REGION OF THE MOON
Donald P. Elston and Charles R. Willingham Apr. 1969 59 p refs *Its* Interagency Rept.: Astrogeol. 14
(NASA ORDER W-12388)
(NASA-CR-106333) Avail: CFSTI CSCL 03B

Plans for a 5-day post-early Apollo roving and flying vehicle mission are presented that provide for the concurrent study of lunar volcanism and impact phenomena as well as exploration of possible sources of hydrated minerals and interstitial ices. The field investigations are designed to obtain information on (1) the evolution of a probable volcanic terrain, (2) the impact and shock metamorphic history of the lunar materials, and (3) the origin, character, and distribution of potential deposits of endogenetically and exogenetically emplaced volatiles. The proposed field work involves reconnaissance of stratigraphy and structure, sampling diverse geologic features at various localities to acquire representative materials, and acquisition of supporting seismic, gravimetric, magnetic, and heat flow data. The scientific support is defined, including the lunar surveying system, magnetics staff, the navigational system, sample-collecting equipment, and equipment for the analysis of samples. The exploration plan covers in detail the proposed traverses. K.W.

N69-40375# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOME FORTRAN SUBPROGRAMS USED IN ASTRONOMY
John A. Ball 16 Jul. 1969 24 p
(Contract AF-19-628-5167)
(AD-691816; TN-1969-42; ESD-TR-69-206) Avail: CFSTI CSCL 3/1

The note is a description of the subprograms DOP, which calculates the Doppler velocity of an earth-bound observer, JULDA which calculates the Julian day-number, MOVE which calculates precession, COORD which performs coordinate transformations, and the GRM series of subprograms which deal with Doppler velocities in terms of a standard galactic rotation model. These subprograms are written in basic FORTRAN and should be useable on a wide variety of computers. Author (TAB)

N69-40407# Ballistic Research Labs. Aberdeen Proving Ground, Md.
INSTRUMENTATION FOR A STUDY OF RANDOM ASTRONOMICAL REFRACTION
William M. Frey May 1969 25 p
(AD-691730; BRL-MR-1980) Avail: CFSTI CSCL 3/1

The report presents a description of the instrumentation system developed for the acquisition of data for a study of short period variations of astronomical refraction. The optical system used for the stellar observations, the comparator for the measurement of the stellar images and the meteorological instrumentation for the determination of the atmospheric parameters are discussed in detail. Author (TAB)

N69-40421*# Geological Survey, Washington, D.C.
THE USE OF SPECTRAL ANALYSIS IN DESCRIBING LUNAR SURFACE ROUGHNESS
Wesley Rozema Dec. 1968 37 p refs *Its* Interagency Report: Astrogeol. 12
(NASA Order W-12388)
(NASA-CR-106336) Avail: CFSTI CSCL 03B

The power spectral density (PSD) function was investigated in recent years as a means of statistically describing land-surface roughness. Knowledge of the PSD functions of lunar topographic profiles is useful for analyzing the manner in which experimental lunar roving vehicles will respond to lunar terrain. In addition, the function enables comparison of the relative roughness of different types of terrain. Certain statistical problems are inherent in the determination of the PSD function. Methods of determining the function were selected and applied consistently to several terrestrial and lunar topographic profiles. Superposition of the graphs of these functions provides an intuitive comparison of the roughness of terrestrial and lunar terrains. Author

N69-40446# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE MECHANISM OF X-RADIATION OF A NEUTRON STAR
G. S. Bisnovatyi-Kogan et al 1969 5 p refs Transl. into ENGLISH from Astron. Zh. (USSR), v. 46, no. 4, 1969 p 721 - 724
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

It is shown that in gas accretion by a neutron star the magnetic field in the flux and the dipole field near the star is $\approx 10^8$ ga, and a collisionless shock is formed in which the electrons have a 10^{11}°K temperature, and emit X-rays. The X-ray spectrum is explained by a synchrotron mechanism and inverse Compton effect. Author

N69-40469# Paris Univ. (France).
USE OF PASSIVE SATELLITES FOR MEASURING STRATOSPHERIC ABSORPTION IN THE NEAR ULTRAVIOLET [UTILISATION DES SATELLITES PASSIFS POUR LA MESURE DE L'ABSORPTION STRATOSPHERIQUE DANS LE PROCHE ULTRAVIOLET]
Pierre Rigaud (Ph.D.) 1968 61 p refs In FRENCH
Avail: CFSTI

The Echo 1 and 2 and Pageos passive satellites were used to measure vertical distribution of the atmospheric optical density and they were observed just before they entered the Earth's shadow. Ultraviolet photometric measurements were performed, with the aid of a Cassegrain telescope, as the solar rays reaching the satellite penetrated different heights of the atmosphere. The vertical distribution of the optical density was computed after correcting for molecular diffusion absorption. The existence of an aerosol layer at an altitude of $\approx$ 20 km was confirmed. ESRO

N69-40478# Mount Wilson Observatory, Pasadena, Calif.
FUNDAMENTAL DETERMINATION OF THE ABSOLUTE SPECTRAL ENERGY DISTRIBUTIONS OF STARS. ABSOLUTE CALIBRATION WORK AT PALOMAR MOUNTAIN Final Report, 1 Apr. 1966 - 31 Aug. 1968
J. B. Oke 29 Jul. 1969 15 p refs
(Contract N00014-67-A-0094-0005)
(AD-691304) CSCL 3/1

A four inch hermetically sealed reflecting telescope has been attached to the prime-focus scanner to provide an observing system for absolute calibration work. Light sources, including a platinum and copper furnace, are observed at a distance of approximately 1200 feet. Since the telescope focal length is only 13 inches these sources look like stars. Thus bright stars such as alpha Lyr are compared directly with the light sources under identical instrumental conditions. It has been found that horizontal extinction can be abnormally large; therefore it is measured several times each night. The absolute calibration is being derived at present from 3500 A to 11000 A and will be extended to 3200 A as soon as possible. Author (TAB)

N69-40496# Lockheed Missiles and Space Co., Palo Alto, Calif.
RESULTS OF DETERMINING THE DYNAMICS OF THE VENUS ATMOSPHERE FROM RESULTS OF MEASURING THE RADIAL VELOCITY OF THE VENERA-4
V. V. Kerzhanovich et al. 1969 7 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 7, no. 4, 1969 p 592-596
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Results are presented of measuring the radial velocity of the landing vehicle of the Venera-4 probe during its descent in the Venus atmosphere. A method and results of determining the velocities of the vertical and horizontal flows during the descent are given. Errors in the measurements are included. Author

N69-40510# Paris Univ. (France). Laboratoire de Physique de l'Atmosphère.
NOCTURNAL LUMINESCENCE AT VALENSOLE DURING IQSY: SKY ISOPHOTES OF 5577A GREEN LINE [LUMINESCENCE NOCTURNE A VALENSOLE PENDANT L'AISC: ISOPHOTES DU CIEL DE LA RAIE VERTE 5577A
A. Vassy and M. Bizien 1968 101 p In FRENCH
(Publ-1968-13) Avail: CFSTI

Nocturnal luminescence data from Valensole (France) during the International Quiet Sun Year are presented as isophote charts for the nights in which measurements were made in 8 azimuths in about one hour. ESRO

N69-40523# Harvard Coll. Observatory, Cambridge, Mass.
THE PROPAGATION OF SHOCK WAVES IN NON-UNIFORM MEDIA (APPROXIMATE METHODS AND ASTRONOMICAL APPLICATIONS)
Robert P. Stefanik Apr. 1969 287 p refs
(Contract AF 19(628)-3877)
(AD-691836; AFCRL-69-0180; SR-5) Avail.: CFSTI CSCL 3/2

Methods for approximate calculations of the non-uniform propagation behavior of shock discontinuities are examined and compared with numerical methods. The object is to delineate and explain the basic physical properties of non-uniform shock wave propagation, to provide a basis for the interpretation of numerical solutions, and to evaluate the effectiveness and limitations of the approximate methods. Astronomical applications are also discussed. Author (TAB)

N69-40569*# TRW Systems Group, Redondo Beach, Calif. Electronic Systems Lab.
APOLLO COMMUNICATIONS SYSTEMS: LUNAR MULTIPATH SIGNAL CHARACTERISTICS
H. W. Belles 15 Oct. 1969 29 p refs
(Contract NAS9-8166)
(NASA-CR-101974; TRW-11176-H368-R000) Avail: CFSTI CSCL 22C

Determination of the characteristics of signals which may occur due to lunar multipaths when the LM is in lunar orbit, and methods of detecting and measuring lunar multipath signals in real time are investigated. The procedure is to determine the specular signal reflections which could be obtained from the lunar surface for the LM in a 60 nm circular orbit using the steerable antenna for communications. The characteristics of the signals which would be received at a ground station are then determined. Of particular interest are the phase or frequency modulations which could be detected in real time. Predictions of the amount and characteristics of multipath signals for the Apollo 12 space flight are included. It is concluded as a result of the analysis that lunar multipath signals may readily be detected at a ground station with a suitable FM discriminator. Author

N69-40592*# Techtran Corp., Glen Burnie, Md.
OPTIMAL TRANSFERS BETWEEN CLOSE ELLIPTICAL ORBITS [TRANSFERTS OPTIMAUX ENTRE ORBITES ELLIPITIQUES PROCHES]
J. P. Marec Washington NASA Sep. 1969 272 p refs Transl. into ENGLISH from ONERA Publ. no. 121, 1967 p 5-235
(Contract NASw-1695)
(NASA-TT-F-554) Avail: CFSTI CSCL 22C

The optimal rendezvous and transfers (minimum mass consumption for a given duration) between close elliptical orbits are analyzed in the case of propulsion systems characterized by a constant ejection velocity and a limited thrust; the performance obtained is compared to the performance of propulsion systems characterized by a modulable thrust and a limited power. The choice of the orbital elements as state components, added to the linearization hypothesis, leads to important simplifications (the adjoint vector is constant, in particular). This gives some general results concerning, among others things, the number of maximum thrust arcs per revolution, the singular cases when the linearized solution is not unique but degenerates into a large number of solutions and the induction phenomena (nonimposed variations of some orbital

elements, induced by the imposed variations of the other orbital elements).
Author

N69-40717# Bologna Univ. (Italy). Inst. of Physics.
UPPER LIMITS OF X-RAY FLUXES FROM SOME QUASARS
D. Brini, F. Frontera, and F. Fuligni Jul. 1969 11 p refs
Avail: CFSTI

Results of two balloon flights, carrying X-ray detectors, are reported. Two sky belts centered around 44° in declination and extending from 6h 20m to 9h 50m and from 16h 40m to 19h 10m R.A. (Right Ascensions) have been scanned with a fairly high sensitivity in the energy range 20–200 keV. Upper limits of the flux from some remarkable objects, such as the quasars 3C196, 3C186 and 3C380 are given. An emission from about 45° D and 17h 30m R.A. cannot be excluded. Unfortunately a latitude drift of the balloons during both flights resulted in a general reduction of sensitivity.
Author (ESRO)

N69-40731# Paris Univ. (France). Laboratoire de Physique de l'Atmosphère.
OZONE CONTENT AT GROUND LEVEL AT PORT AUX FRANCAIS (KERGUELEN ISLAND), 1961–1966 [CONCENTRATION DE L'AIR EN OZONE AU NIVEAU DU SOL A LA STATION DE PORT AUX FRANCAIS (ILES KERGUELEN), 1961–1966]
A. Vassy 1968 39 p refs In FRENCH
(Publ-1968-5) Avail: CFSTI

Measurements of the partial pressure of ozone in the atmosphere at ground level have been recorded at Port aux Francais (Kerguelen Island) and the daily mean value are tabulated in this report for the period 1961–1966.
ESRO

N69-40732# Paris Univ. (France). Laboratoire de Physique de l'Atmosphere.
MEASUREMENT OF NIGHT SKY LUMINESCENCE AT VALENSOLE DURING IQSY: GREEN LINE 5577 Å [MEASURE DE LA LUMINESCENCE NOCTURNE A VALENSOLE PENDANT L'AISC: RAIE VERTE 5577 Å]
A. Vassy and M. Bizien 1968 13 p refs In FRENCH
(Publ-1968-2) Avail: CFSTI

Measurements of the emittance of the night sky at Valensole during the International Quiet Sun Year have been recorded and are tabulated. They were made with a Fabry-Perot interferometer, a photometer oriented in 8 azimuths and a standard source during 10 days about new moon.
ESRO

N69-40760# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF A PLANETARY ATMOSPHERE ON FRESNEL DIFFRACTION OF ULTRASHORT RADIOWAVES
V. A. Andrianov 1969 8 p refs Transl. into ENGLISH from Radiotek. i Elektron. (Moscow), v. 14, no. 8, 1969 p 1355–1361
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

An asymptotic representation is obtained for the attenuation function in the Fresnel penumbra domain during ultrashort wave diffraction around a planet surrounded by an atmosphere. Numerical estimates are made in the case of occultation of the planet Mars. Results of the computations show that the refraction attenuation, displacement of the geometric umbra boundary, and change in the period of oscillation of the Fresnel curve are slight in the Mars atmosphere. Moreover, a divergence from results of computing the refraction attenuation by geometric optics formulas is noted. This is considered important in interpreting the measurement results.
Author

N69-40772# Lockheed Missiles and Space Co., Palo Alto, Calif.
PLANETARY NEBULAE AS POSSIBLE X-RAY SOURCES
G. S. Khromov 1969 3 p refs Transl. into ENGLISH from Astron. Zh. (Moscow), v. 46, no. 4, 1969 p 747–749
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The statistics of identification are discussed, together with the negative results of an examination of the hypothetical mechanisms of X-radiation by planetary nebulae. It is shown that, with the modern accuracy of determining the coordinates of X-ray sources in the 4 to 8 keV energy range, planetary nebulae should be considered more often as objects of a field than as the subject of identification. It is pointed out that the situation can change on making the transition to the low energy range since it is easy to show that the hot nuclei of planetary nebulae can become noticeable sources of X-radiation in the energy band around 0.25 keV.
Author

N69-40797 Michigan Univ., Ann Arbor.
METEORITIC ORIGIN AND CONSEQUENT ENDOGENIC MODIFICATION OF LARGE LUNAR CRATERS: A STUDY IN ANALYTICAL GEOMORPHOLOGY
Richard Joseph Pike, Jr. (Ph.D. Thesis) 1968 440 p
Avail: Univ. Microfilms: HC $19.80/Microfilm $5.60 Order No. 69-2371

The problem of lunar crater genesis is investigated by quantitative topographic analysis. Operational techniques adapted from dimensional analysis provide means for inferring geologic processes that have affected larger, more complex lunar craters. Measurements of five crater surface dimensions are compiled for over 2500 terrestrial and lunar craters of known and unknown origin. Overall diameter, flat floor diameter, interior relief, and exterior relief are compared graphically with rim crest diameter. A simple linear power function, or isometric expression, represents each of the three latter relationships for most freshly formed terrestrial explosion craters, uneroded meteorite craters, and rimmed lunar craters up to a diameter of 10–20 km. Most randomly-oriented lunar craters under this threshold diameter are interpreted as comparatively unaltered explosion pits. Available data suggest that most of the explosive events were meteoritic rather than endogenic.
Dissert. Abstr.

N69-40996# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF ZONAL HARMONICS ON THE MOTION OF THE FIFTH SATELLITE OF JUPITER
V. N. Kiriushenkov [1969] 8 p ref Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 3: Fiz.-Astron. (Moscow), no. 2, 1969 p 80–87
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

This influence is expressed as an expansion of the Jupiter attractive-force function in a Legendre polynomial series. The orbit of the two-fixed-centers problem is taken as the intermediate satellite orbit. This intermediate orbit includes perturbations due to the second and third zonal harmonics. A set of differential equations for the perturbing function is solved by successive approximations. These equations take into account the effect of the second and third zonal harmonics on the satellite, and also include the most influential terms due to the perturbing effect of the fourth, fifth, and sixth harmonics.
R.B.

N69-41018# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF GALILEAN SATELLITES ON THE MOTION OF THE FIFTH SATELLITE OF JUPITER
V. N. Kiriushenkov [1969] 6 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 3: Fiz.-Astron. (Moscow), no. 4, 1969 p 65–70
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The perturbing effect of Galilean satellites on the motion

of the fifth satellite of Jupiter is investigated. The orbit of the two fixed centers problem is taken as the intermediate orbit of the fifth satellite. Such an intermediate orbit includes perturbations due to the second, third, and partially, the fourth zonal harmonics of the expansion on the Jupiter attractive force function in a Legendre polynomial series. Results of the investigation show that perturbations of the considered satellite under the effect of Galilean satellites are quite insignificant, hence only the secular perturbations should be taken into account. Author

N69-41103*# Sandia Corp., Albuquerque, N. Mex. Planetary Quarantine Dept.
PLANETARY QUARANTINE PROGRAM. Quarterly Progress Report
Sep. 1969 48 p refs
(NASA Order W-12853)
(NASA-CR-106475; QPR-14) Avail: CFSTI CSCL 03B

Microbial survivor data obtained for spores embedded in epoxy were used to test the physically-based kinetic sterilization model. Activities related to developing a management information system to provide the data needed by the Planetary Quarantine Officer are reported, and sample output sheets are included. A version of the crater debris model was used to estimate the organic contamination densities on the lunar surface resulting from a lunar module ascent stage impact. The results show that the maximum safe distance of about 50 km is less than the conservative safe distance (60 km) derived for biological material. An rverview is presented on the bioburden experimentation and modeling program, and the problems involved in estimating the number of microbes on an object in a clean room. To predict the bioburden of Viking 1973 at various confidence levels and the number of samples required to verify burden estimates, a modified birth and death model was used to obtain rough estimates. Experiments were also performed to determine how the initial sample populations used in thermo-radiation experiments effected sterilization. M.G.J.

N69-41114# Lockheed Missiles and Space Co., Palo Alto, Calif.
MUTUAL PERTURBATIONS OF MARS SATELLITES
S. N. Vashkov'iak [1969] 4 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 3: Fiz.-Astron. (Moscow), no. 1, 1969 p 87 - 90
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Formulas giving the secular and long period perturbations in the Mars satellite Demos under the influence of Phobos are obtained. An estimate is made of these perturbations. The intermediate orbits of the Mars satellites are constructed on the basis of a solution of the generalized problem of two fixed center. The influence of the sun on the motion of the Mars satellites is also studied. Using the system of canonical variables connected with the intermediate elements, the perturbed motion equation is successfully integrated and an expression is obtained for the perturbation due to the sun. On the basis of the intermediate orbits the canonical system of equations are integrated and secular and long period perturbations due to the mutual influence of the Mars satellites Phobos and Demos obtained. Author

N69-41143 Arizona Univ., Tucson. Steward Observatory.
THE SPIRAL STRUCTURE OF OUR GALAXY: SUMMARY AND OUTLOOK
Bart J. Bok 17 Sep. 1969 28 p Conf. held at Tucson, Ariz., 4 Sep. 1969
Avail: Issuing Activity

The spiral arms of demarcated streamers of hydrogen gas that concern the optical and radio astronomers are studied. The answers to two questions are considered to be fundamental to a theory for the spiral structure of the galaxy. These are: (1) What are the principal characteristics of a major spiral arm? (2) What is the pattern of overall spiral structure applicable to the galaxy? Other aspects of the dynamics of spiral structure discussed are gravitational theory, origins of spiral patterns, radio spiral structure of the galaxy, optical spiral structure, and influence of magnetic fields. F.O.S.

N69-41146# Arizona Univ., Tucson. Steward Observatory.
PHOTOMETRIC STANDARDS FOR THE SOUTHERN HEMISPHERE
Bart J. Bok and Priscilla F. Bok Aug. 1969 40 p refs Submitted for publication *Its* Preprints of the Steward Observ. No. 24
(Grant NSF GP-7882)
Avail: Issuing Activity

Astronomical observations for the Southern Hemisphere are discussed and tabulated. Star Tifft 1 was taken as the standard star for the sequences. Tables presented are: axis of the large Magellanic Cloud, G L Carinae, H D 101545, I C 2944, Centaurus, Normal 1, 2, and 3, SA 169, and SA 205. Star photographs of selected areas are included. F.O.S.

N69-41150*# National Aeronautics and Space Administration, Washington, D.C.
A LONG-RANGE PROGRAM IN SPACE ASTRONOMY: POSITION PAPER OF THE ASTRONOMY MISSIONS BOARD
Robert O. Doyle (Harvard College Obs.), ed. Jul. 1969 316 p refs
(NASA-SP-213) Avail: SOD $1.50; CFSTI CSCL 03A

The potential for advancement of astronomy by the space program is considered. Astronomical instruments located in space can reach regions of the electromagnetic spectrum which do not penetrate the earth's atmosphere. This multiwavelength approach is shown to be a multidisciplinary activity. One of the major unresolved problems in astronomy is considered to be the Crab Nebula which consists of an enormous cloud of glowing gas resulting from the explosion of a star in A.D. 1054. Close to the center is a pulsar which may be a neutron star, in which matter is compressed to a density of 10 billion tons per cubic inch. The energy radiated is more than 100 times greater than that of the sun, despite the fact that the pulsar is only six miles in diameter. The long range program developed is considered to be well balanced, worthwhile, and imaginative. F.O.S.

N69-41171*# Bellcomm, Inc., Washington, D.C.
DIFFERENCES BETWEEN PROPOSED APOLLO SITES: FAR INFRARED EMISSIVITY EVIDENCE
A. F. H. Goetz and L. A. Soderblom (Calif. Inst. of Tech.) 9 Jun. 1969 13 p refs
(Contract NASw-417; Grant NGL-02-002-003)
(NASA-CR-106401; TR-69-340-2) Avail: CFSTI CSCL 03B

Infrared emissivity comparison spectra of nine areas on the lunar surface, each 40 km in diameter, indicate that the majority of the lunar surface, including the five prime Apollo sites, has a constant Si:O ratio so far as present infrared techniques are able to detect. However, an anomaly in the 8 - 9 μ region of the emissivity spectrum of the crater Plato is interpreted as evidence of significantly different Si:O ratio in the mineral assemblage exposed on that surface. Author

N69-41186*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF GRAVITY ASSISTED TRAJECTORIES FOR SOLAR-PROBE AND DEEP-SPACE MISSIONS
John W. Young (M.S. Thesis - Va. Polytechnic Inst.) May 1969 92 p refs
(NASA-TM-X-61970) Avail: CFSTI CSCL 22C

Various aspects of the planetary flyby concept not generally emphasized in previous studies are treated, and a detailed analysis

of flyby orbits is presented to obtain an understanding of the basic mechanics involved. Two types of missions are considered: (1) a solar probe, with the objective of either achieving a solar impact or of placing the vehicle in close proximity to the surface; and (2) a deep space mission, with the objective of either escape from the solar system or to achieve an aphelion distance greater than that possible without employing the flyby concept. Results are presented to illustrate the effect of flybys at Venus and Jupiter on such parameters as transfer time, momentum and energy changes at the perturbing planet, approach and flyby corridor widths, and conditions at perihelion passage with respect to possible telemetry transmission from the vehicle to earth. The analyses indicate that maximum reductions in perihelion of about 65% over that for direct transfers are possible for Venus flyby-solar probe missions. For similar missions to Jupiter with launch velocities greater than about 10.5 km/sec, solar impacts are possible for multiple flyby distances between 1 and 15 planet radii. Only marginal improvements over direct transfer orbits were achieved for Venus flyby-deep space missions, but significant increases in performance were noted for the same flybys at Jupiter. A.C.R.

N69-41321*# Stanford Univ., Calif. Inst. for Plasma Research.
A THEORY OF THEORIES
P. A. Sturrock. Jul. 1969. 36 p refs
(Grant NGR-05-020-272; Contracts F44620-69-C-0008; N00014-67-A-0112-0006)
(NASA-CR-106482; SUIPR-324) Avail: CFSTI CSCL 03B

The aim is to set out a bookkeeping procedure by which a scientist may compare the conclusions of a theory with facts obtained by reduction of observational data with the aim of assessing the hypothesis on which the theory is based. It is argued that the appropriate formalism is probability theory, and that the key process is the inductive process as represented by Bayes' theorem. Formulas are derived which show (1) how the assumed probability of the hypothesis should be adjusted in response to information concerning one item, and (2) how such estimates concerning more than one item may be combined. Models were developed to show those features. The method is illustrated by a worksheet indicating the way in which a few observational facts about pulsars may be used to appraise both the neutron-star hypothesis and the white-dwarf hypothesis. Author

N69-41379 Arizona Univ., Tucson. Steward Observatory.
THE CARINA SPIRAL FEATURE Progress Report
B. J. Bok, A. A. Hine, and E. W. Miller. 1969. 48 p refs Presented at Basel Symp. on Galactic Struct., 29 Aug.–4 Sep. 1969
(Grant NSF GP-7882)
Avail: Issuing Activity

The existing data on the distribution of O and B stars, of optical and radio HII sources, of HI, and of cosmic dust have been assembled for the Carina-Centaurus section of the Milky Way, $1^{II} = 265^{\circ}$ to 305°. The published data are supplemented by recent photoelectric UBV data and new photographic material. Two working diagrams of the Carina spiral feature were prepared. The feature is sharply bounded at $1^{II} = 282^{\circ}$ and again at $1^{II} = 295^{\circ}$ in the distance range from 1.5 to 6 kpc from the sun. Its outer rim is observed from the sun almost tangentially to a distance of 8 kpc from the sun. The feature is found to bend at distances greater than 9 to 10 kpc from the sun, a result shown by both radio HI and radio HII data. Basic data for the stellar, gas, and dust components of the feature are presented. The O and early B stars and the HII regions are closely associated, and within 6 kpc of the sun they are concentrated in the range $285^{\circ} < 1^{II} < 295^{\circ}$. A working diagram shows that the O and B star peaks and the HII peak have a width of 800 parsecs (12°) at 4 kpc from the sun, whereas the HI width is at least 1500 parsecs at the same distance. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N69-40082*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-58, VOLUME 1 FOR THE PERIOD 1 MAY – 30 JUNE 1969. FLIGHT PROJECTS
31 Jul. 1969. 64 p refs
(Contract NAS7-100)
(NASA-CR-106342; JPL-SPS-37-58-Vol-1) Copyright. Avail: CFSTI CSCL 22A

Progress reports are summarized for Mariner Mars projects 1969 and 1971. Investigations discussed include new models or modifications of spacecraft, telecommunication, support and guidance, and electronic systems. Results indicate all systems perform satisfactorily. E.H.W.

N69-40103*# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
TELEVISION BROADCAST SATELLITE (TVBS) STUDY RESEARCH AND TECHNOLOGY IMPLICATIONS REPORT, VOLUME 2
R. W. Hesselbacher. 6 Oct. 1969. 59 p
(Contract NAS3-9708)
(NASA-CR-72511) Avail: CFSTI CSCL 22B

Technologies were investigated which were required by the satellite system conceptual designs generated in the TVBS study. Pertinent technologies were identified, their parameter improvements with time were predicted and their impact on significant TVBS system parameters was evaluated. Ranking criteria were used to list technologies in order of recommended priority for development as a function of satellite power level and launch date. The most critical items are high efficiency transmitters, high power/voltage components, large solar arrays, interaction of flexible structures with control systems, thermal control of high power transmitters, highly reliable long life operation, and low cost ground receiving systems. The study demonstrates that broadcast satellites are feasible in the next decade. Author

N69-40116# Hawker Siddeley Dynamics, Ltd., Stevenage (England). Space Div.
A GUIDE TO THE FEASIBILITY STUDY OF EUROPA 3 PLUS TWO BLUE-STREAK BOOSTERS
C. E. Allen, comp. Jul. 1969. 73 p. Sponsored by ELDO
(HSD-TP-7168) Avail: CFSTI

This document is a summary and a guide to the main facts and conclusions presented in HSD-TP-7159 'A Feasibility Study of a Launch Vehicle using Europa 3 with Additional Blue-Streak Boosters'. ESRO

N69-40152# European Space Vehicle Launcher Development Organization, Paris (France).
POSSIBILITIES OF A EUROPEAN LAUNCH VEHICLE PROGRAMME FOR PAYLOADS FROM 500 TO 2000 kg [MOEGLICHKEITEN EINES EUROPAEISCHEN TRAEGER-RAKETENPROGRAMMS FUER NUTZLASTEN DER KATEGORIE 500 kg BIS 2000 kg]
Richard J. Jonke. Sep. 1969. 13 p. In GERMAN. Presented at the Colloq. on Direct Satellite Broadcasting, Hamburg, 9–10 Sep. 1969
(ELDO-Publ-20) Avail: CFSTI

This report discusses possible European launch vehicle programmes which might meet communication satellite requirements.

The relationship between the payload and volume of the types of synchronous satellites suitable for European broadcasting is expressed in terms of the satellite shroud diameter. The satellite diameter influences the choice of alternative solutions in planning the configurations of future European launch vehicles. ESRO

N69-40233# Rome Univ. (Italy). Centro Ricerche Aerospaziali.
THERMOELASTIC EFFECTS ON ARTIFICIAL GRAVITY GRADIENT SATELLITES
Carlo Arduini and Giulano Quozzo Aug. 1968 105 p refs In ITALIAN; ENGLISH summary
(Rept-18) Avail: CFSTI

Very long and flexible appendices or booms are commonly used aboard of gravity stabilized satellites. These appendices are intended to increase the the inertia moments about particular axes in order to get the stabilization of a predetermined direction with respect to the gravity field. The solar radiation induces thermoelastic flexural deformation of these structures thus influencing the stabilization characteristics. The present paper analizes the temperature distribution inside these booms, the consequent thermal stresses and structural deformations. Static and dynamic changes in attitude due to the insolation are then analyzed; plots and diagrams concerning some typical cases are also included. Author

N69-40262# Joint Publications Research Service, Washington, D.C.
APPENDIX: SOVIET ARTIFICIAL EARTH SATELLITES, SPACECRAFT AND THEIR TECHNICAL CHARACTERISTICS
V. V. Bazykin *In its* USSR Achievements in Space Res. (1st Decade in Space, 1957 - 1967) 24 Jan. 1969 p 511 - 615 (See N69-40251 24-13)
Avail: CFSTI

A tabulated history of the Soviet artificial earth satellites is presented. Included is a short technical discussion of each satellite. F.O.S.

N69-40269*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA SPACE VEHICLE DESIGN CRITERIA-ENVIRONMENT. MAGNETIC FIELDS: EARTH AND TERRESTRIAL
Mark Harris (Exotech, Inc., Washington) and Robert Lyle (Exotech, Inc., Washington) Washington Mar. 1969 70 p refs
(NASA-SP-8017) Avail: CFSTI CSCL 22B

Information on the strength and direction of the natural magnetic fields is presented for use as a guide in vehicle design. Covered are the geomagnetic field (the volume of space about the Earth i.e., the magnetosphere), the interplanetary field (Sun's field), and the fields of the planets and their natural satellites. Concerning the geomagnetic field, the present state of knowledge limits the availability of a definitive analytical model to about 6.6 Earth radii (synchronous altitude). For the regions beyond this altitude, the available information has been reviewed to determine both quantitative and qualitative data useful for design purposes. The information includes data on variations, disturbances, the various magnetic currents, regions, and effects in the magnetosphere. The analytical models of the geomagnetic field that are discussed include the spherical harmonic expansion model, the quadrupole model, the spin-axis dipole model, and the tilted dipole model. The geocentric, geodetic, geomagnetic, local geomagnetic, solar ecliptic, and solar magnetospheric coordinate systems are briefly defined. Dimensions, units of measurement, and conversion factors are given. K.W.

N69-40427# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
SPIN DECAY OF A CLASS OF SATELLITES CAUSED BY SOLAR RADIATION. PART 2. ARBITRARY ATTITUDE OF THE SPIN AXIS
D. B. Cherchas Aug. 1969 55 p refs
(Grant AF-AFOSR-1490-68)
(AD-691700; UTIAS-TN-137) Avail: CFSTI CSCL 22/2

The analysis studies the manner in which solar radiation heating and pressure acting on the long flexible antennae of a spin stabilized satellite can cause the spin rate to decrease significantly. The problem is formulated by finding a differential equation for the shape of a boom antenna under heating effects and inertial forces and deriving the expression for torque acting on the satellite due to solar radiation pressure on booms of known shape. By assuming small boom deflections and incorporating, for the first time, the spin axis attitude and solar exposure histories, the spin rate versus time histories of two example satellites, Alouette I and Explorer XX, are found, and excellent agreement obtained with actual flight data. Author (TAB)

N69-40429# Utah Univ., Salt Lake City. Upper Air Research Lab.
DETERMINATION OF THE ASPECT FOR INSTRUMENTS IN A ROCKET PAYLOAD
Kenneth E. Phillips Apr. 1969 67 p refs
(Contract F19628-67-C-0275)
(AD-691501; AFCRL-69-0172; UU-69-1; SR-2) Avail: CFSTI CSCL 19/7

Equations of motion are developed for describing the attitude of a rocket in terms of the parameters roll, pitch and yaw. The transformation matrix relating the uncaged system of coordinates to the local earth-fixed coordinate system is also found. Computer program listings are also included which permit the user to fit the equations of motion to any particular rocket flight. The programs also permit the user to calculate the orientation of any vector, defined in a coordinate system fixed to the rocket body, in terms of any desired earth-fixed system. The last section illustrates the use of a computer program by fitting the equations of motion to a particular rocket, Aerobee 3.615, and from these results, the aspect for individual instruments is computed. Author (TAB)

N69-40441# Accumetrics Corp., Cambridge, Mass.
SOUNDING ROCKET POST BURNOUT STABILIZATION STUDY Final Report, 5 Aug. 1968 - 4 May 1969
Donald H. Fryklund and Oiva R. Anderson 4 Jun. 1969 68 p refs
(Contract F19628-69-C-0029)
(AD-691512; AFCRL-69-0222) Avail: CFSTI CSCL 21/2

The stability conditions for a sounding rocket have been examined by expressing the Euler equations of motion in terms of power. Stability criteria were derived from this power in Euler quantities and their time derivatives. Data for a divergent Nike-Tomahawk flight were examined on the basis of momentum, energy and power about the roll and transverse axes and correlated with the derived power expression and with aerodynamic input power. Coning divergence appears to be initiated by a perturbation at last stage burnout, which is followed by a transient phase of about four seconds duration during which energy is being fed into the vehicle transverse axis. This transient phase is characterized by a coning rate higher than the natural pitch frequency and by raped increase in coning angle. One hypothesis put forth as a possible source of the transverse energy was parametric pumping due to the non-alignment of the coning axis and velocity vector. Design criteria were established for a damper mounted on a de-spun portion of the vehicle. This damper is de-coupled from the roll motion and, therefore, acts directly to absorb energy out of the transverse axis. Author (TAB)

N69-40573*# TRW Systems Group, Redondo Beach, Calif. Control System Analysis Section.
APOLLO 2 DAP POSTFLIGHT ANALYSIS

J. A. Bossart, W. H. Delashmit, W. R. Hamel, R. C. Kropf, and R. Lee. 17 Oct. 1969. 126 p. refs.
(Contract NAS9-8166)
(NASA-CR-101969; TRW-11176-H365-R000) Avail: CFSTI CSCL 22B

Inflight performance analyses are presented for the Lunar Module (LM), the Command and Service Module (CSM), and the digital autopilots during powered flight phases of the Apollo 11 mission. Thrust vector control performed well during five burns and left only small residual velocities after each burn. Significant residuals after transearth injection were attributed to a rapidly moving yaw location caused by propeller expenditure and lightly damped yaw slosh oscillations. Engine gimbal start transients were less than 0.4 degree for nearly all burns. Digital autopilots of the service module reaction control system performed well although the propellant consumption during transportation and docking prior to LM withdrawal was higher than predicted. The LM digital autopilot performed well in accordance with the software design throughout the mission. The bulk of the postflight analysis centered on the powered descent phase. It was found that approximately 66 pounds propellant were used by manual control with 51 pounds propellant consumation during manual attitude hold phase of the descent. The powered ascent burn from lunar liftoff to lunar orbit insertion appeared nominal; anomalous looking displays were attributed to nominal astronaut-lunar gymbal control interactions. G.G.

N69-40598# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
A PILOTED SIMULATION OF THE TAKE-OFF OF A SUPERSONIC TRANSPORT AIRCRAFT, WITH AND WITHOUT A TAKE-OFF DIRECTOR
B. N. Tomlinson and T. Wilcock. Aeron. Res. Council. 1969. 63 p. refs. Supersedes RAE-TR-67109; ARC-29143
(ARC-R/M-3594; RAE-TR-67109; ARC-29143) Copyright. Avail: CFSTI; HMSO: £1 7s 6d

The aim of the simulation was to study the take-off behaviour of the aircraft in difficult conditions, high weight on a hot day and reduced visibility. The potential value of a take-off director was also assessed. Over 600 take-offs by 20 airline and test pilots were analyzed statistically. Many take-offs included an engine failure at a critical stage and some were performed with crosswind and atmospheric turbulence. Statistical analysis showed that use of a take-off director reduced the variability of the take-off performance. Most pilots thought the director would help to reduce the workload during take-off, particularly in the event of an engine failure. Author (ESRO)

N69-40602# Rome Univ. (Italy).
SOME TECHNICAL FEATURES OF LOW ORBIT SATELLITES
C. Arduini, G. Buongorno, U. Ponzi, and G. Ravelli. Mar. 1969. 25 p. refs.
(Rept-21) Avail: CFSTI

The present paper examines the main features and technical characteristics of low orbit scientific satellites, which are individualized by the fact that the aerodynamic effects are predominant and directly influence the design of the spacecraft. Following a review of the main factors derived from the environment and the most characteristic missions, the paper deals with problems associated with stabilization, aerodynamic characteristics, and electronics. Author

N69-40748# Hawker Siddeley Dynamics, Ltd., Stevenage (England). Space Div.
ELDO STUDY 8.5: A FEASIBILITY STUDY OF A LAUNCHING VEHICLE USING EUROPA 3 WITH ADDITIONAL BLUE STREAK BOOSTERS
E. Large comp. May 1969. 334 p.
(Contract ELDO-CTR/17/7/29)
(HSD-TP-7159) Avail: CFSTI

This report discusses in detail the performance capabilities of a launch vehicle using Blue Streak as a first stage with two Blue Streak strap-on boosters and a 14 tonnes lox/hydrogen upper stage. The performance objective is to place a payload of 2 tonnes into a synchronous orbit, launching the vehicle from French Guyana. The nature and magnitude of the engineering problems involved and the proposed solutions are studied, as well as the design and development program. ESRO

N69-40781*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE INFLUENCE OF THERMAL DISTORTION ON THE PERFORMANCE OF GRAVITY-STABILIZED SATELLITES
Gerd Kanning. Washington, Nov. 1969. 15 p. refs.
(NASA-TN-D-5435) Avail: CFSTI CSCL 22B

An analysis is made of the effect of thermal distortion of booms on the attitude of a gravity-stabilized satellite. The attitude computed when only the effects of thermal distortion on the solar pressure torques were considered is compared with the attitude computed when the interdependent effects of changing geometry and mass distribution were considered as well. The calculations were made for several satellites having either symmetrical or asymmetrical boom arrangements. Calculations for all arrangements were made for low orbits inclined 45° to the sunline. In addition, calculations were made for one symmetric configuration for synchronous attitude. The results indicated that including the effects of changing geometry and mass distribution is not important for symmetrical arrangements, but is important for asymmetrical boom arrangements. Furthermore, for asymmetrical boom arrangements, it was found that the thermal distortion can provide some compensation for the unbalanced solar pressure torques attributable to asymmetry. Thus, the best pointing accuracy might be achieved with booms designed to have a specific thermal distortion. Author

N69-40801# European Space Research Organization, Paris (France).
ESRO/ELDO BULLETIN, SUPPLEMENT: HEOS-1
Aug. 1969. 55 p. partly in FRENCH and partly in ENGLISH. Prepared jointly with ELDO
Avail: CFSTI

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N69-40803# European Space Research and Technology Center, Noordwijk (Netherlands).
SCIENTIFIC AIMS AND EXPERIMENTS
B. G. Taylor *In* ESRO ESRO/ELDO Bull., Suppl.: HEOS-1 Aug. 1969 p 14-25 (See N69-40801 24-31)
Avail: CFSTI

The overall mission of the HEOS-1 satellite is reviewed and a list of the experiments, their main features and the responsible groups is given. The technical performance and scientific data acquired up to June 1969 are presented and discussed. ESRO

N69-40804# European Space Research and Technology Center, Noordwijk (Netherlands).
THE HEOS-1 SATELLITE
G. H. Booth *In* ESRO ESRO/ELDO Bull., Suppl.: HEOS-1 Aug. 1969 p 26-30 (See N69-40801 24-31)
Avail: CFSTI

A description of HEOS-1 satellite is given and the satellite structure, power supply system attitude and spin-rate control devices as well as the telemetry and command control system are discussed. ESRO

N69-40806# European Space Research and Technology Center, Noordwijk (Netherlands).
THE HEOS-1 LAUNCH OPERATIONS
D. Lennertz *In* ESRO ESRO/ELDO Bull., Suppl.: HEOS-1 Aug. 1969 p 37-43 (See N69-40801 24-31)
Avail: CFSTI

The HEOS-1 launch campaign at Cape Kennedy, from the arrival of the satellite flight model on 22 October 1968 to the launch on 5 December 1968 is described. ESRO

N69-40807# European Space Research and Technology Center, Noordwijk (Netherlands).
HEOS-1: POST LAUNCH OPERATIONS [HEOS-1: OPERATIONS APRES LANCEMENT]
M. L. Delahais *In* ESRO ESRO/ELDO Bull., Suppl.: HEOS-1 Aug. 1969 p 44-48 In FRENCH (See N69-40801 24-31)
Avail: CFSTI

The events which occurred during the early days of the life of the HEOS-1 satellite are described and the orbital elements and the testing of the operational state of the different experiments are discussed. The coordination between the different tracking stations is also described. ESRO

N69-40808# European Space Operations Center, Darmstadt (West Germany).
HEOS-1 SATELLITE AS SEEN FROM ESOC [LE SATELLITE HEOS-1 VU DE L'ESOC]
E. A. Roth *In* ESRO ESRO/ELDO Bull., Suppl.: HEOS-1 Aug. 1969 p 49-52 In FRENCH (See N69-40801 24-31)
Avail: CFSTI

The operations carried out at the ESRO Operations Center on the occasion of the launch of HEOS-1 satellite are described and the computation of the orbital elements, data processing and attitude control are described. ESRO

N69-40813*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PREFLIGHT OPTICAL EVALUATION OF THE RIGHT-HAND HATCH WINDOWS OF GEMINI MISSIONS 7, 8, 9, AND 12
George P. Bonner, Michael F. Heidt, Carl L. Kotila, John A. Lintott, John E. Novotny et al. Washington Nov. 1969 19 p
(NASA-TN-D-5471) Avail: CFSTI CSCL 22B

Preflight studies of the transmission, schlieren, and resolution qualities of the Gemini spacecraft G-7, G-8, G-9, and G-12 right-hand hatch windows were conducted. Transmission measurements were made for angles of incidence of 0°, 15°, 30°, and 45°. All windows were comparable in transmission qualities, and the schlieren studies indicated that all windows were excellent in optical quality. Relative resolution was tested by resolution-chart photography. The G-12 window proved superior in resolution. Author

N69-40821*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CAPSULE SYSTEM ADVANCED DEVELOPMENT STERILIZATION PROGRAM
A. R. Hoffman, J. T. Wang, and M. R. Christensen. 15 Oct. 1969 39 p refs
(Contract NAS7-100)
(NASA-CR-106393; JPL-TR-32-1320) Avail: CFSTI CSCL 22B

A primary objective of the program was to gain experience in critical new technologies, one of which was capsule sterilization. The sterilization objective was to develop and apply terminal sterilization requirements and operations in a manner so that they might be implemented for a possible early Mars mission. The sterilization program included constructing thermal analytical models performing microbiological assay during the assembly of the capsule, calculating process times, determining process requirements and procedures, subjecting the lander to an engineering sterilization environment, and subjecting the capsule to a terminal sterilization cycle. The CSAD sterilization process is shown to be representative of a conservative process that might be used to terminally sterilize a flight capsule. Author

N69-40874*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
APOLLO SATURN 5: CONSOLIDATED INSTRUMENTATION PLAN FOR AS-506 (APOLLO 11)
D. E. Clark 3 Jun. 1969 69 p
(NASA-TM-X61921; K-V-059/6) Avail: CFSTI CSCL 22B

This report presents the consolidated instrumentation plan for employing optical and electronic data acquisition systems to monitor the performance and trajectory of Apollo Saturn V vehicle 506 during the launch phase of the mission (prelaunch, liftoff to insertion). Telemetry, optical, and electronic tracking equipment onboard the vehicle and data transmission systems, and geophysical instrumentation are also described. This plan reflects the general instrumentation requirements for Apollo Saturn 5 and is not intended to conflict with or supersede that document. The information presented in this document reflects planning concepts developed prior to June 3, 1969. Author

N69-40938*# Martin Marietta Corp., Denver, Colo.
EXPERIMENTAL MATERIAL HANDLING DEVICE Final Report
W. H. Tobey, R. T. French, and D. M. Adams. Sep. 1969 204 p refs
(Contract NAS8-30069)
(NASA-CR-102279; MCR-69-414) Avail: CFSTI CSCL 22B

In this phase, an experimental material handling device (EMHD) was designed, fabricated, and tested to evaluate Man Rated Flight material Handling Device concepts. The tests utilized the Space Operations Simulation facility. Two test subjects, seated in a fixed base Apollo Command Service Module (CSM) mockup, controlled the CSM dynamics and the EMHD operations. A target was mounted on the simulator's six-degree-of-freedom moving base. Tests involved approaching and positioning relative to the target, attaching to it, and stabilizing it after attachment. Three attachment modes were used: (1) clamping on the target exterior, (2) hooking flanges on the target, and (3) attaching with a simulated adhesive head. The simulation technique involves computation of the problem dynamics on an analog computer which determines the commands for the moving base. Author

N69-40948*# Bellcomm, Inc. Washington, D.C.
ONBOARD CHECKOUT OF A MID-70's SPACE STATION
J. R. Birkemeier 6 Jun. 1969 38 p refs
(Contract NASw-417)
(NASA-CR-106455; TM-69-1031-3) Avail: CFSTI CSCL 22B

Principal checkout functions are sampling data from test points, comparing test point data to various limits, predicting failures through trend analysis, and diagnosing failed or failing systems. The memory and speed requirements of the onboard computer were evaluated for a wide range of test points. The memory and speed requirements are within the capabilities of some aerospace computers already available or under development. Computers of the mid-70's are expected to have sufficient memory and speed to handle as many as 10,000 test points. Diagnostic testing, particularly that requiring the application of stimuli to spacecraft systems, introduces a number of complications relating to timing and control of the checkout program. Resulting software problems should be resolved. Author

N69-41086# Library of Congress, Washington, D.C. Aerospace Technology Div.
SOVIET INTERPLANETARY STATION TECHNOLOGY (VENERA-TYPE SPACECRAFT)
Aleksander Dolgich *In its* Foreign Sci. Bull., Vol. 5, no. 9 Sep. 1969 p 1–13 refs (See N69-41085 24-34)
Avail: Issuing Activity

An interpretive review is presented of automatic interplanetary station (AMS) technology, based on the Soviet open literature. Special attention is devoted to the Venera-type spacecraft, which is similar in design to the Luna, Mars, and Zond interplanetary stations, as well as to the Soyuz-type spacecraft. All Soviet spacecraft, from the first satellite to the Soyuz-type vehicles, have been developed in a single design bureau headed by the so-called "Chief Designer," and assembled, tested, and prepared for flight in a single plant operated under the general supervision of the same Chief Designer. The descent sections of manned and unmanned spacecraft are the most difficult technical components in space technology, and their development has resulted in significant delays in the schedule of the Soviet space program. Author

N69-41168*# Time-Zero Corp., Torrance, Calif.
OGO-F THERMAL SUBSYSTEM FOR THE EP-5 (EXPERIMENT PACKAGE) Final Engineering Report, 9 Nov. 1967 – 15 Jun. 1969
Sam Pollack Jun. 1969 277 p refs
(Contract NAS5-11095)
(NASA-CR-106479) Avail: CFSTI CSCL 22B

The design, development, fabrication, tests, and integration of a thermal subsystem for maintaining a controlled environment for Experimental Package Five (EP-5) on the OGO-F spacecraft are discussed. The thermal capabilities of two experiments, F-22 (search coil magnetometer) and F-24 (VLF polarization and wave normal direction antenna system) were involved. Results of detailed thermal analysis and thermal tests conducted to insure subsystem capabilities are presented. Author

N69-41176# Congress. House. Committee on Science and Astronautics.
SUPPLEMENTAL REVIEW: NASA-OSSA PROJECTS
GPO 1969 40 p Hearings before the Comm. on Sci. and Astronaut., 91st Congr., 1st Sess., No. 9, 16 Oct. 1969
Avail: Subcomm. on Space Sci. and Appl.

NASA hearings presented pertain to a supplemental review of space science and applications projects. Emphasis is placed on developments in the Viking, Earth Resources Technology satellite, and Applications Technology Satellite programs and their economic implications and cost estimates. G.G.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N69-40083# Notre Dame Univ., Ind. Coll. of Engineering.
THERMAL STRESSES IN OPEN CYLINDRICAL SHELLS WITH CIRCULAR CUTOUTS
Teoman Airman, Lawrence H. N. Lee, and Roger E. Hoffman Dec. 1968 59 p refs
(Contract N00014-68-A-0152)
(AD-691282; Themis-UND-68-2) Avail: CFSTI CSCL 20/12

The report is concerned with thermal stress in an open, circular cylindrical shell with a circular hole. The shell is subjected to a stationary uniform heat flow and the condition that thermal insulation exists at the boundary of the hole. The stresses and deformation of the shell under the prescribed conditions are analyzed. The analysis is based on the method of superposition. The actual stresses in the shell may be considered as the sum of the following three parts: (a) stresses caused by the given heat flow in a similar shell without hole, (b) stresses in the shell caused by edge loads at the boundary of the hole and (c) stresses in the shell caused by the local disturbance of the heat flow near the hole. A method of obtaining numerical results is also outlined. Author (TAB)

N69-40087*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL INVESTIGATION OF FLUTTER AT MACH 3 OF ROTATIONALLY RESTRAINED PANELS AND COMPARISON WITH THEORY
Charles P. Shore Washington Oct. 1969 33 p refs
(NASA-TN-D-5508) Avail: CFSTI CSCL 20K

An experimental investigation was conducted at a Mach number of 3 in the Langley 9- by 6-foot thermal structures tunnel to study the effects of damping and edge rotational restraint on the flutter characteristics of thermally stressed, flat, isotropic panels with length-width ratios of 3.3 and 3.7. Measured panel natural vibration frequencies were compared with calculated frequencies in order to estimate the panel edge rotational restraints. Comparisons of experimental and theoretical flutter results show that small-deflection theory can adequately predict the flutter of stressed panels up to the point of buckling if edge rotational restraint is accounted for and aerodynamic damping and frequency-independent hysteretic structural damping are included. Furthermore, the region, where the theoretical transition-point value of the flutter parameter is very sensitive to variations in panel length-width ratio and edge rotational restraint when structural damping is zero, becomes insensitive to these variations when the appropriate value of structural damping is used. Author

N69-40110# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN ANALYSIS OF THE FORCED OSCILLATIONS OF A SYSTEM WITH PERIODICALLY CHANGING COEFFICIENTS
A. Tonol et al 9 Jun. 1969 12 p refs Transl. into ENGLISH from Rev. Roumaine Sci. Tech., Ser. Mecan. Appl. (Bucarest), v. 13, no. 1, 1968 p 113–119
(AD-692141; FTD-HT-23-163-69) Avail: CFSTI CSCL 20/11

The report investigates the influence of the periodic parameter change of a linear system with one degree of freedom on forced oscillations in a case when the basic interval of instability is its dominant mode, i.e., when the period of parameter change is equal to half the excitation force. If the linear resistance is insufficient, the natural oscillations will be unstable at a certain interval of the external frequency, and at the boundaries of this interval the

amplitude of the external frequencies exceeds all limits. In case the linear resistance of the system is sufficient for suppressing the interval of unstable natural oscillations, the forced oscillations are limited. But the maximum amplitude strongly depends on the phase angle of the excitation force. For a smaller phase angle interval it can even be that the maximum amplitude will be less than for the case corresponding to a similar system with constant coefficients and resistance. Author (TAB)

N69-40115# Southampton Univ. (England). Inst. of Sound and Vibration Research.
SOME CONTACT PROBLEMS IN ELASTICITY THEORY
G. M. L. Gladwell and F. A. Adubi Jul. 1969 30 p refs
(ISVR-TR-23) Avail: CFSTI

The variations of pressure under single and double punches indenting an elastic half-plane uniformly are obtained by developing the relevant elastic equations using Fourier transform theory, and solving these equations approximately by an engineering method involving the use of influence coefficients. Both smooth and adhesive contacts are considered and variation of state compliance with punch distance from the origin of coordinates plotted. It has been found that compliance varies in direct proportion to the width of a punch. Author (ESRO)

N69-40141# Toronto Univ. (Ontario).
SPHERICAL ELASTIC-PLASTIC WAVES IN SOLID MEDIA
Sabodh K. Garg Feb. 1969 43 p refs
(Contract AF 33(615)-5313)
(AD-690799; UTIAS-TN-132) Avail: CFSTI CSCL 13/13

The propagation of loading and unloading elastic-plastic waves in an ideally elastic-plastic infinite medium, containing a spherical cavity, and obeying the Tresca yield condition is considered when a time dependent pressure pulse is applied on the cavity surface. The numerical method, based upon finite differences, treats the various wave fronts exactly. It is shown that the speeds of the unloading wave fronts are dependent upon the decay rate of the applied pressure. The results for cavity displacement are compared with those obtained from an existing method. Author (TAB)

N69-40161# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY OF ELASTIC SYSTEMS
I. Ya. Amiro 26 Feb. 1969 18 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 2, no. 12, 1966 p. 33-40
(AD-692134; FTD-HT-23-826-68) Avail: CFSTI CSCL 13/13

The axial compression of thin elastic cylindric shells is investigated under critical loading with special emphasis on possible upper and lower critical load limits. The concept is illustrated by calculating the critical load on two straight rigid links connected by an elastic hinge and simply supported at their lower ends. Calculations show that the minimum load at which equilibrium is lost depends inversely on the rigidity of the system. TAB

N69-40219*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF PRESSURE DISTRIBUTION ON THE SHAPE OF TENSION SHELL ENTRY VEHICLES
James Wayne Sawyer (M.S. Thesis - Virginia Polytech. Inst.) Apr. 1969 62 p refs
(NASA-TM-X-61917) Avail: CFSTI CSCL 20K

Theoretical and experimental investigations were conducted to improve accuracy in calculating pressure distributions for various tension shell decelerator shapes and to evaluate the effects on derived shapes resulting from the application of different pressure distributions. Although tension shell shapes were derived by Newtonian aerodynamics in conjunction with linear membrane theory, experimental values obtained on other bluff shapes indicated that Newtonian theory does not describe the actual pressure distribution; better agreement was obtained by the integral relation theory. Consequently, a computational procedure involving a one-strip integral relation technique for calculating pressure distributions was devised for deriving new tension shell shapes. Since nose radius and the free-stream Mach number affected the integral relation pressure distributions, their effects on integral-relation-derived tension shell shapes were investigated. Pressure distributions were obtained at Mach 3.0 in a thermal structures tunnel and are presented for typical Newtonian- and integral-relation-derived tension shell shapes. Author

N69-40220*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A NUMERICAL ANALYSIS OF RESTRAINED SHRINKAGE STRESSES IN ABLATION HEAT SHIELDS
Marvin B. Dow (M.S. Thesis, Virginia Univ.) Jun. 1969 77 p refs
(NASA-TM-X-61915) Avail: CFSTI CSCL 20K

An approximate method is presented for analyzing restrained shrinkage stresses during space flight cooling. An alternating direction iterative method is used to obtain numerical solutions of a two-dimensional mixed boundary-value problem for rectangular elastic plates. Plane strain theory is assumed, with the heat-shield length and thicknesses as controlling dimensions. The finite difference method is used to integrate the governing differential equations for displacements and stresses. The calculated stresses agree with exact results well away from the heat-shield edges, but at the restrained-free edge corner of the heat shield, they do not agree with the prescribed boundary stresses. It is concluded that calculated stresses are valid for regions other than the corner vicinity, but are not valid near the corner. Results from cold soak tests of ablation heat-shield models indicate that the location of maximum restrained shrinkage stress depends on the ablation material thickness. Calculated stresses are qualitatively compared with the test data. Author

N69-40244*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE SENSITIVITY OF BUCKLING OF AXIALLY COMPRESSED FIBER-REINFORCED CYLINDRICAL SHELLS TO SMALL GEOMETRIC IMPERFECTIONS
Michael F. Card (Ph.D. Thesis Virginia Polytech. Inst.) Jun. 1969 167 p refs
(NASA-TM-X-61914) Avail: CFSTI CSCL 20K

An index of imperfection sensitivity is obtained by investigating the character of the initial postbuckling region for a geometrically perfect cylindrical shell. Using techniques of perturbation theory, equations governing postbuckling behavior of a multilayered orthotropic cylinder are developed. The theory considers the effects of nonlinear deformations induced by loading prior to buckling. Solutions for postbuckling displacements are obtained by converting the governing equations and boundary conditions to a system of second-order differential equations, written in terms of finite differences at stations along the length of the cylinder. The resulting algebraic equations are solved by matrix algebra exploiting Gaussian elimination. A computer program was developed to solve the resulting large systems of simultaneous equations and to perform the numerical differentiation and integration necessary to calculate the imperfection sensitivity index. Relative values of the index are investigated for three types of fiber-reinforced cylinders: helically wrapped glass-epoxy and boron-epoxy cylinders, and aluminum cylinders overwrapped with boron-epoxy. Author

N69-40274 Purdue Univ., Lafayette, Ind.
CORRELATION AND PREDICTION OF THERMAL CONTACT CONDUCTANCE FOR NOMINALLY FLAT SURFACES

Chung Kuo Hsieh (Ph.D. Thesis) 1968 195 p
Avail: Univ. Microfilms: HC $8.80/Microfilms $3.00 Order No. 69-2931

An attempt is made to correlate the literature data of thermal contact conductance in terms of derived dimensionless groups. Data for ferrous and non-ferrous materials in contact within different environments are correlated. Surfaces covered in this work include nominally flat and nominally wavy surfaces with various degrees of roughness. Two cases are considered in treating the radius of contact spots; namely, as constant and as variable. The results show that, by treating the contact radius as variable, better convergence of data for nominally flat rough surfaces can be obtained using the derived dimensionless groups, while the trend of the data for nominally flat smooth surfaces exhibits a steep increase at high pressures, not predicted by theory. A wide scattering of data is seen in the correlation for wavy surfaces which is only presented as an illustration. Dissert. Abstr.

N69-40280 Rensselaer Polytechnic Inst., Troy, N.Y.
BUCKLING OF AN ELLIPSOIDAL SHELL OF REVOLUTION DUE TO INTERNAL PRESSURE
Philip Louis Rotondo (Ph.D. Thesis) 1968 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-2478

The primary object of this work is to provide a means to predict the internal pressure that an ellipsoid of revolution can withstand before circumferential buckling occurs. The differential equations for the buckling problem are developed using the method of adjacent equilibrium. The most important assumptions are that deflections must be small and vary linearly with the pressure, the shell must be thin and have uniform thickness. There also are no provisions to handle initial imperfections. Due to the length and complexity of the resulting equations, the solution is found by the variation of the total energy of the shell and therefore is an upper bound. Deflection shapes are assumed to be defined by trigonometric functions that satisfy the natural boundary requirements. Results for complete ellipsoids and clamped semiellipsoids are tabulated and plotted for several breadth to rise ratios and are compared to similar results that were published during the course of this study. The comparisons are satisfactory. Dissert. Abstr.

N69-40300# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGN OF RODS BENT IN COMPRESSION BEYOND THE ELASTIC LIMIT
R. A. Skripnikova 6 Jun. 1969 8 p refs Transl. into ENGLISH from Russian j.
(Contract F33657-68-D-0865/P002)
(AD-692136; FTD-HT-23-1318-68) Avail: CFSTI CSCL 20/11

A numerical method is presented for solving a differential equation for a bent axis of a compression-bent rod in its elastoplastic stage. It is assumed that the rod is acted upon by a longitudinal force and an arbitrary system of transverse loads. The hypothesis of flat cross sections is accepted, and the bends are assumed to be small in comparison to the length. In this work the main effort is placed on constructing an iteration method for the solution and on clarifying the problem of the solution convergence. A solution algorithm for a hinge-supported rod loaded by a concentrated bending moment is analyzed as an example of constructing iteration formulas. TAB

N69-40306# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMUM PARAMETERS OF CYLINDRICAL SANDWICH SHELLS WITH CORRUGATED-SHEET CORE STIFFENED BY ELASTIC FRAME
B. A. Panasenko 22 May 1969 10 p refs Transl. into ENGLISH from Samoletostroyeniye i Tekhn. Vozdushnogo Flota (USSR), no. 8, 1966 p 101–105
(AD-692359; FTD-HT-23-1281-68) Avail: CFSTI CSCL 01/3

A method for determining the optimum dimensions of straight, circular, cylindrical, transversely stiffened sandwich shells having cores made of a shell material corrugated in saw-tooth form is proposed. A shell of a given outer radius, length, and elastic characteristics of the material is subjected to a uniform compression load. The optimum values of the following unknown parameters have to be determined. Core parameters saw-tooth height, pitch, and sheet thicknesses; thickness; identical of the face layers distance between equally spaced identical transverse frames and their moment of inertia and buckling stress. Author (TAB)

N69-40309# Arizona Univ., Tucson. Engineering Experiment Station.
NONLINEAR FINITE ELEMENT ANALYSIS
Ralph M. Richard and Melvin L. Callabresi [1968] 41 p refs
(EES-13) Avail: CFSTI

A finite element model is developed for the analysis of the stresses, strains, and displacements in plane stress or plane strain systems in which the stresses exceed the proportional limit of the material. The model is a direct generalization of the triangular plate element which has been used extensively in linearly elastic systems so that computer programs which utilize this model for linear analysis may be readily extended to include nonlinear effects. Differential stress strain relationships are used to generate the differential node force displacement relationships. A system of simultaneous ordinary nonlinear equations results when proportional loading is prescribed. These equations are then integrated numerically to yield the displacements for each increment of proportional loading. Several problems involving plane stress systems of practical size and interest are solved and the results are compared with those obtained experimentally. Author

N69-40359*# United Aircraft Corp., East Hartford, Conn. Research Labs.
SIMPLIFIED PROCEDURES FOR ESTIMATING FLAPWISE BENDING MOMENTS ON HELICOPTER ROTOR BLADES. PART 2: TABLES
Anton J. Landgrebe Washington NASA Oct. 1969 92 p ref
(Contract NAS1-7880)
(NASA-CR-1441) Avail: CFSTI CSCL 20K

Tables are presented of the bending moment transfer coefficients as a supplement to previously published procedures and charts for estimating flapwise bending moments on helicopter rotor blades. These transfer coefficients are for each independent parameter of blade bending moment for nine combinations of mass and frequency parameters and six advance ratios (0.25 to 1.4). In addition, coefficients for the fourth and fifth harmonics for the low advance ratios (0.25 to 0.5) and six blade stations for the hingeless blade coefficients are given. Author

N69-40376# State Univ. of New York at Buffalo.
DYNAMIC RESPONSE OF CYLINDRICAL SHELLS TO MOVING PRESSURE LOAD Final Report
Herbert Reismann 30 Jul. 1969 5 p refs
(Grant DA-ARO(D)-31-124-G894)
(AD-691784) Avail: CFSTI CSCL 13/13

A brief description of the results of an investigation concerned with an accuracy assessment of engineering theories of elastic plates and shells subjected to suddenly applied surface loads is given. The objective of the investigation was to generate exact solutions within the framework of different plate and shell theories to guide designers in their selection of the appropriate theory when analyzing light construction under transient dynamical conditions. Author (TAB)

N69-40443# Brown Univ., Providence, R.I. Engineering Div.
LARGE DEFLECTION ANALYSIS OF ELASTIC PLASTIC PLATES AND SHELLS
Pedro V. Marcal Jun. 1969 33 p refs
(Contract N00014-67-A-0191)
(AD-691443; TR-1) Avail: CFSTI CSCL 20/12

A finite element method is described for the large displacement elastic-plastic analysis of plates and shells. The method combines the piecewise linear geometric stiffness matrices with the piecewise linear generalized stress strain relations for an elastic-plastic shell. The method is discussed with special reference to a triangular plate element with membrane stretching and flexure. A quadratic displacement function was used for the in-plane displacements, and a piecewise modified complete cubic displacement function was used for the out-of-plane displacements. This last resulted in a nonconforming element which exhibited good convergence features. The method was implemented on a general purpose computer program. Case studies were made of simply supported square plates under uniform pressure. Studies were also made of axisymmetric shells using an axisymmetric shell element. Reselts for both types of structures were found to agree with available theoretical and experimental results in the literature. Author (TAB)

N69-40445# Lockheed Missiles and Space Co., Palo Alto, Calif.
THREE-DIMENSIONAL DOUBLY-PERIODIC PROBLEMS OF ELASTICITY THEORY (T)
G. N. Savin et al 1969 4 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 187, no. 5, Aug. 1969 p 1016 - 1018
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method is proposed for the solution of boundary value problems of elasticity theory for a space perforated with cylindrical cavities whose axes are parallel, and a complete investigation is presented of the infinite systems for algebraic equations obtained. The cross section of the elastic body being considered is a plane with circular holes, whose centers are at the nodes of an oblique-angled lattice. The Origin of a cylindrical coordinate system is placed at the center of each of the holes where the axes are superposed on the longitudinal axes of the cavities. The proposed method can be utilized to solve problems of a layer with a doubly-periodic system of cylindrical cavities. Author

N69-40524# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
WIND EFFECTS ON STRUCTURES
G. K. Korbacher Apr. 1969 28 p refs
(AD-691699; UTIAS-27) Avail: CFSTI CSCL 13/13

Wind exposed structures in general and high buildings of conventional or unorthodox shape in particular are known to suffer from quite a number of wind load problems. These may affect usuage and functions of the building, human comfort in and around it, design of glass panels and curtain walls, location of heating and ventilation duct inlets and outlets and the structures design loads and safe life. Where analytical treatments are inappropriate or become too complex for supplying answers to such problems, wind tunnel model testing-provided proper simulation of the characteristics of the natural wind can be achieved on the model - is the most promising approach. Lately, apart from testing rigid models, also aeroelastic models of structures are wind tunnel tested to furnish data on wind excited motions and harmonic oscillations of aeroelastically soft full scale structures as a function of speed and direction of the natural wind. Author (TAB)

N69-40544# Brown Univ., Providence, R.I. Div. of Engineering.
LARGE DEFLECTION ANALYSIS OF ELASTIC-PLASTIC SHELLS OF REVOLUTION Technical Report, 1 Jun. - 30 Nov. 1968
Pedro V. Marcal Dec. 1968 38 p refs Presented at the ASME/AIAA 10th Conf. on Struct., Structural Dyn. and Mater., New Orleans, Apr. 1969
(Contract N00014-67-A-0191-0004)
(AD-691444; TR-1) Avail: CFSTI CSCL 20/12

A finite element method is developed for the large deflection elastic-plastic analysis of axisymmetric shells of revolution. Results were obtained for a torisphere under internal pressure and also for centrally loaded spheres. A study was made of the effect of elastic-plastic behavior on the buckling of spheres with axisymmetric imperfections subjected to external pressure. It was found that plastic yielding played a significant role in reducing the buckling pressure of these shells. The influence of plastic yielding increased with increase of the thickness to radius ratio. Author (TAB)

N69-40548# Brown Univ., Providence, R.I. Div. of Engineering.
A NOTE ON THE COMPLEMENTARY ENERGY BOUNDING THEOREM FOR TIME INDEPENDENT MATERIALS
N. W. Townsend and J. B. Martin Jun. 1969 20 p refs
(Contract N00014-67-A-0191-0003)
(AD-691783; TR-3) Avail: CFSTI CSCL 20/11

The complementary energy bounding theorem for time independent materials is reformulated in terms of the external load space and external load paths. This formulation illustrates that the optimum bound obtainable can be identified with a maximum complementary work path in load space. In certain simple cases this optimum bound can be computed directly. Author (TAB)

N69-40563 Colorado Univ., Boulder.
LOCAL EFFECTS OF A CONCENTRATED LOAD APPLIED TO ORTHOTROPIC BEAMS
John Bosco Chulsoo Yu (Ph.D. Thesis) 1968 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-14283

An exact solution for bending, shearing, and normal stresses as well as the curvature and displacement of infinitely long orthotropic beams loaded by a concentrated load is presented. The formal solution is expressed in terms of Fourier integrals. The analytical results are compared with the numerical results obtained from the evaluation of the integrals. The numerical solutions presented are for three different materials: three-layered plywood, pine wood, and laminated delta wood. The final values of the local effects for these materials are reported in the form of curves and tables. The effect of the orientation of the grain on the stresses, curvatures, and displacements is investigated. The exact values for the shearing stresses due to two opposed and slightly removed concentrated loads are also presented. Dissert. Abstr.

N69-40608# North Carolina State Univ., Raleigh. Mathematics Dept.
APPLIED MATHEMATICS RESEARCH PROJECT Final Report
W. J. Harrington 31 Jul. 1969 5 p refs
(Grant AF-AFOSR-444-66)
(AD-691847; AFOSR-69-1996TR) Avail: CFSTI CSCL 20/12

The Applied Mathematics Research Group has been involved in studies in the area of the mathematical theory of elasticity describing the stress properties of thin elastic materials. The paper lists the project reports prepared in these studies. TAB

N69-40714# Lockheed Missiles and Space Co., Palo Alto, Calif.
EQUIVALENT STIFFNESS OF A DOUBLY-PERIODIC GRATING REINFORCED BY ELASTIC RINGS (T)
E. I. Grigolyuk et al 1969 4 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 187, no. 6, Aug. 1969 p 1254 - 1256
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Consideration is given to the problem of reducing a uniformly perforated plate to its equivalent solid plate in the sense of tensile

or bending stiffness. A solution is presented for the case of isotropic tension of an infinite plate with a doubly-periodic system of identical circular holes reinforced by thin elastic rings of a different material than the grating. The appropriate doubly-periodic problem in an exact formulation is solved, based on the assumption that the ring is working under tension. The results are valid if the grating does not differ greatly from a regular one, and the loading is almost isotropic at infinity. Author

N69-40767# Houston Univ., Tex. Cullen Coll. of Engineering.
IDENTIFICATION OF MATERIAL PROPERTIES OF A NONLINEARLY ELASTIC MATERIAL BY QUASILINEARIZATION
Billy E. Baker (M.S. Thesis) and S. Bart Childs Jun. 1969 42 p refs
(Contract N00014-68-A-0151)
(AD-691401; RE-5-69)

A method of determining certain characteristic flexural rigidities and elastic properties of non-linearly elastic materials is presented. A moment curvature relation in the form of a hyperbolic tangent law is introduced. An identification method utilizing quasilinearization and a least squares fitting technique is used to solve the nonlinear differential equation derived from the moment curvature relation, subject to boundary values representing deflections of the bar at discrete points. Deflection data from numerical simulations of a non-linearly elastic prismatic bar are used to demonstrate the identification method. Numerical experiments relating the accuracy of the identification method to the number and accuracy of the boundary values are presented. Conclusions based on the numerical experiments are included. Author (TAB)

N69-40786# Lehigh Univ., Bethlehem, Pa.
MODULATED SIMPLE WAVES: AN APPROACH TO ATTENUATED FINITE AMPLITUDE WAVES
M. P. Mortell and A. Trowbridge May 1969 23 p refs
(Contract DAAD-05-69-C-0053)
(AD-691767; CAM-110-4) Avail: CFSTI CSCL 20/14

The paper describes some of the techniques which are currently being used to investigate finite amplitude waves in elastic and viscoelastic materials. In particular we show how the simple wave solutions, which describe finite amplitude plane progressing waves in elastic materials, may be modified to describe the effects of reflection from boundaries, deformations behind curved wave fronts, and the effects of locally small damping mechanisms. Author (TAB)

N69-40832# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
TENSION, TORSION AND COLUMN PROPERTIES OF COMMERCIALLY PURE TITANIUM TUBING AT ROOM TEMPERATURE Technical Report, Sep. 1958 – Mar. 1960
Robert G. Henning Dec. 1960 30 p
(AD-691494; WADD-TN-60-201) Avail: CFSTI CSCL 13/11

Tensile, torsion and column properties were determined at room temperature on one heat of commercially pure titanium A 55 tubing in 1-inch and 3/8-inch outside diameters and varying wall thicknesses. Typical stress-strain diagrams are presented for torsion and tension. Torsion/tension and column/tension ratios vs diameter/wasll thickness graphs are presented. Author (TAB)

N69-40858# Bettis Atomic Power Lab., Pittsburgh, Pa.
SEAL-SHELL-2: A COMPUTER PROGRAM FOR THE STRESS ANALYSIS OF A THICK SHELL OF REVOLUTION WITH AXISYMMETRIC PRESSURES, TEMPERATURES, AND DISTRIBUTED LOADS
C. M. Friedrich Jun. 1969 25 p refs
(Contract AT(11-1)-GEN-14)
(WARD-TM-398-ADD-2) Avail: CFSTI

A revised version of Seal-Shell-2 is described. The reference surface of the shell may be placed anywhere between the inside and outside surfaces, not just at the middle surface. Also, the program may be used to plot stress against segment index. The program is written in FORTRAN 4 and has been used on Philco-2000, IBM-704, and CDC-6600. Author (NSA)

N69-40935*# North Carolina State Univ., Raleigh.
THE RADIATION RESISTANCE OF CYLINDRICAL SHELLS
Charles J. Runkle and Franklin D. Hart Washington NASA Oct. 1969 128 p refs
(Grant NGR-34-002-035)
(NASA-CR-1437) Avail: CFSTI CSCL 20K

A study is made of the radiation resistance of long cylindrical shells in contact with an ideal compressible acoustic medium of infinite extent. The goal of the study is the development of useful engineering results in graphical form which are valid over a wide frequency range for broad types of shell materials and for various acoustic media. The problem is formulated mathematically in terms of two descriptive differential equations: one for the cylindrical shell, and the other for the acoustic medium. The equation of motion for the shell which is excited by a source in the interior is developed in terms of the radial displacement of the surface subject to the hypotheses that the shell, composed of isotropic elastic material, obeys thin shell equations of deformation. The equation of motion of the acoustic medium is the well known wave equation. The solution to these equations is obtained by imposition of a boundary condition establishing velocity compatibility at the shell-fluid interface and by the requirement that the results satisfy the radiation condition in the limit at large distances from the surface of the shell. Author

N69-40951# Lockheed Missiles and Space Co., Palo Alto, Calif.
DETERMINATION OF THE ELASTIC AND STRENGTH MODULI OF ORIENTED FIBERGLASSES UNDER TENSION ON THE BASIS OF NONDESTRUCTIVE CHECKING OF PARAMETERS OF THEIR COMPOSITION AND STRUCTURE
M. Z. Medvedev et al [1969] 12 p refs Transl. into ENGLISH from Mekhan. Polimerov, Akad. Nauk Latv. SSR (Riga), No. 2, 1969 p 332–341
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The possibility of determining the elastic modulus of a fiberglass oriented in the direction of the installation of the bonding fiber glass is examined. The influence of porosity on the elastic modulus of fiber glass is calculated, and the computational dependences of the elastic modulus determined by statistical processes. It was concluded that the suitability of the obtained dependences for the practical purposes of nondestructive testing of fiberglass bonded in one and two mutually perpendicular directions has been confirmed experimentally. F.O.S.

N69-41040*# AiResearch Mfg. Co., Los Angeles, Calif.
TEST REPORT ON FATIGUE-TESTING OF NICKEL-200 PANELS
F. A. Biastre, ed. 10 Jan. 1969 17 p
(Contract NAS1-6666)
(NASA-CR-66842; AP-68-4617) Avail: CFSTI CSCL 20K

This report presents the results of fatigue tests conducted on nickel-200 alloy to obtain low cycle thermal fatigue performance data for application to the regeneratively cooled structures on the hypersonic research engine. The objective was to determine the advantages of using Ni-200 material as opposed to Hastelloy-X. The results show that the low cycle fatigue life of the engine structure would be increased from 136 cycles for Hastelloy-X up to 225 cycles for Ni-200 at the most severe design operating condition. This is due to the higher thermal conductivity and higher ductility of the Ni-200 at operating temperature as compared to Hastelloy-X.

The relatively lower creep-rupture strength of the Ni-200 would not, however, permit application in structural parts under high mechanical stress. Author

N69-41122*# AiResearch Mfg. Co., Los Angeles, Calif.
EXPERIMENTAL INVESTIGATION OF THE COOLING AND STRUCTURAL PERFORMANCE FOR THE HRE COWL LEADING EDGE
L. F. Jilly, ed. 30 Jul. 1969 89 p refs
(Contract NAS1-6666)
(NASA-CR-66843; AP-69-5347) Avail: CFSTI CSCL 20K

Tests to determine the heat transfer and pressure drop performance of the hypersonic research engine rectangular-offset, brazed plate fin cooling passage geometry are discussed. Two fin configurations were used during the tests: (1) 20 fins per inch, 0.050 inch high, .006 inch thick and (2) 28 fins per inch, .050 inch high and .006 inch thick. The fins were formed from Hastelloy X sheet material and brazed between .025 inch thick Hastelloy X plates, using Palniro 1 braze alloy. The test mints were approximately 6 inches wide by 6 inches long. The fin geometries tested were different than previously tested. Data were taken at Reynold's numbers up to 55,000 (based on the fin passage hydraulic diameter)or well beyond existing data for somewhat similar fin geometries. These data indicate the measured pressure drop is as much as 25 percent below that predicted but the heat transfer coefficient correlates well with the predicted values. Author

N69-41141*# National Aeronautics and Space Administration. Langley Research Center, Langley Center, Va.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF END-PLANE ROTATIONS OF TRUNCATED CONES UNDER BENDING LOADS
Richard W. Faison, John L. Gilbert, and William H. Richards Washington Nov. 1969 30 p refs
(NASA-TN-D-5536; L-6019) Avail: CFSTI CSCL 20K

An analytical and experimental investigation of the bending characteristics of truncated conical beams subjected to constant moment loading was made. It has been determined that elementary beam theory becomes inadequate for determining the stiffness of truncated conical sections as the cone half-angle increases. A correction coefficient which accounts for the degeneration of stiffness from that computed by use of the elementary beam theory is presented to be applied to the stiffness parameter of thin wall truncated cone sections. The correction coefficient was determined by membrane theory analysis of a truncated cone subjected to end-plane rotations, and corroborative experimental results were obtained from small scale tests. Author

N69-41145# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering
TRANSTABILITY FLUTTER ANALYSIS OF SIMPLY SUPPORTED SKEW PANELS
S. Durvasula and E. S. Nair Aug. 1969 35 p refs
(AE-2525) Avail: CFSTI

The transtability flutter problem of simply supported parallelogrammic panels was formulated using double Fourier sine series for deflection, and the Rayleigh Ritz method. The in-plane stresses are represented in terms of oblique components. The lateral load acting on the panel was estimated employing the two dimensional static aerodynamic theory. The critical values of the dynamic pressure parameter were obtained for various skew angles in the case of rhombic panels under uniform compression (oblique component) along the two opposite edges. Approximate values of these parameters when the panel is under uniform oblique shear are tabulated. Author

N69-41164*# Martin Marietta Corp., Denver, Colo.
USE OF DYNAMIC SCALE MODELS TO DETERMINE LAUNCH VEHICLE CHARACTERISTICS. VOLUME 1: ANALYTICAL INVESTIGATION Final Report
I. J. Jaszlics and A. C. Park Aug. 1969 172 p refs
(Contract NAS8-21101)
(NASA-CR-102272; MCR-68-87-Vol-1) Avail: CFSTI CSCL 22D

A study to develop modeling techniques that can be used for launch vehicle and space structure dynamic simulation when the parameters which define similarity between prototype and model cannot be fully satisfied is reported. In practice, all but the largest models have to make compromises in structural simulation and even very large models, using direct replica scaling, cannot duplicate all essential parameters. During the study it became obvious that there is need for a comprehensive summary of the scaling techniques applicable to the design of launch vehicle and space structure models. This summary is provided; it describes general model scaling methods and develops basic similarity laws for various structures including liquid propellants and shell structures. A survey of material and manufacturing limitations and a summary of the economic aspects of model construction and testing is included. Author

N69-41165*# Martin Marietta Corp., Denver, Colo.
USE OF DYNAMIC SCALE MODELS TO DETERMINE LAUNCH VEHICLE CHARACTERISTICS. VOLUME 2: EXPERIMENTAL INVESTIGATION Final Report
F. A. Penning Aug. 1969 106 p refs
(Contract NAS8-21101)
(NASA-CR-102280; MCR-68-87-Vol-2) Avail: CFSTI CSCL 22D

The use of launch vehicle distorted models to provide experimental information regarding launch vehicle prototype behavior is considered. The free vibrations of cylindrical and conical shell structures of individual segments of the second stage of the Saturn 5 rocket are detailed. Test conditions are clamped boundary conditions and no pressure or axial loads. From the governing differential equations for shell vibrations the important parameters are identified. These are scaled for exact dynamic similitude and then manipulated to produce distorted models. By using the laws of similitude and from numerical values of scaled quantities, vibration studies of models are related directly to the prototype. Author

N69-41185*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE ROLE OF STRESS CONCENTRATIONS IN STRUCTURAL FATIGUE
John H. Crews, Jr. (Ph.D. Thesis--Va. Polytechnic Inst.) May 1969 155 p refs
(NASA-TM-X-61969) Avail: CFSTI CSCL 20K

An analysis of fatigue behavior at stress-concentration sites is presented for sheet specimens containing a central hole under remote uniaxial cyclic loading. This investigation was conducted in three phases: (1) analysis of local cyclic stress-strain conditions at the stress-concentration site; (2) study of fatigue crack initiation; and (3) study of the initial stage of propagation for cracks growing from the stress-concentration site. The generally close correlation between calculated and observed results demonstrated the utility of local stress analyses in the prediction of fatigue behavior for structural components containing stress concentrations. The procedures used are expected to be generally applicable for fatigue analyses involving more complicated configurations and loading. Author

N69-41229*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALCULATION OF THE PENETRATION FLUX FOR A

MULTIWALL STRUCTURE ON THE LUNAR ORBITER SPACECRAFT

Donald H. Humes Washington Nov. 1969 25 p refs
(NASA-TN-D-5455) Avail: CFSTI CSCL 20K

The method used to calculate the penetration flux for the Lunar Orbiter multiwall structure consisting of the thermal barrier and the photo-subsystem container is presented. The calculation of the efficiency factor showed that the multiwall structure provided better protection against meteoroids than a single aluminum wall with the same mass per unit area. The calculated efficiency factor was 5.9. The flight data from the five Lunar Orbiter missions verified that the multiwall structure was more effective than a single aluminum wall of the same mass per unit area, but the data were not adequate to determine the value of the multiwall efficiency factor. Author

N69-41231# Los Alamos Scientific Lab., N.Mex.
INTERNAL BLAST LOADING OF SCALE-MODEL EXPLOSIVE-PROCESSING BAYS

C. A. Anderson 7 Jul. 1969 26 p refs
(Contract W-7405-eng-26)
(LA-4145) Avail: CFSTI

A study of the protective capability of high-explosive-processing buildings subjected to internal blast loading is summarized. One-eighth-scale reinforced concrete models of the facility were tested against blast from a wide range of scaled explosive-charge weights. Shock overpressures, strains, and deflections were measured at critical points of the models. The structural response of the models is compared with calculated dynamic response based on elastic and plastic material behavior, and spallation and excessive deflection of the models are compared with conventional explosive-effects data. From the test results, guide lines were established for the protection of personnel in typical explosive-processing buildings. NSA

N69-41311# Atomic Weapons Research Establishment, Aldermaston (England).
SHOCK AND VIBRATION: A SELECTED BIBLIOGRAPHY

Janet E. Goodall and L. Corbett Aug. 1969 32 p refs
(AWRE/Lib/Bib/19) Copyright. Avail: HMSO 4s 6d

A bibliography covering the period 1967–1968 is presented, with selection being biased toward military and space environments. General areas of coverage in the field of shock and vibration are: (1) theory, including design techniques, as well as environments and their prediction; (2) interpretation and simulation of phenomena; (3) specifications; (4) shock and vibration factors in transportation; (5) testing, including combined environmental testing; and (6) instrumentation and recording. A.C.R.

N69-41396 National Lending Library for Science and Technology, Boston Spa (England).
MISLEADING PICTURES AND SOURCES OF ERROR IN THE INTERPRETATION OF ELECTRON MICROFRACTOGRAPHS

E. Mencarelli et al. 1 May 1969 16 p refs Transl. into ENGLISH from Mem. Artill. Franc. (France), no. 1, 1968 p 97–123
(NLL-T-6210-(5809.95)) Avail: Natl. Lending Library, Boston Spa, Engl. .1 NLL photocopy coupon

Examples of three categories of misleading microphotographs are discussed. These are changes in surface fracture caused by mechanical and chemical sources, fractures showing posteriori changes in the replicas, and cases in which replicas have replication or artefact defects. E.H.W.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N69-40031# California Univ., Berkeley. Coll. of Education.
HEAT TRANSFER FROM RADIOISOTOPIC POWER SOURCES IN POROUS MEDIA

V. E. Schrock, T. Fernandez, S. Garribba, and S. Narra Jun. 1968 96 p refs
(Contract N00228-68-C-0554)
(AD-691213; NE-68-1) Avail: CFSTI CSCL 18/14

Heat transfer from radioisotopic full fuel capsules was studied experimentally and analytically for the situation in which the capsule is buried in a porous earth material saturated with water as would occur when such a capsule becomes accidentally buried in the ocean floor. Experimental conditions have been extended beyond the range reported previously by testing devices with different length-diameter ratios and using a greater range of burial depths. The previously reported correlation for natural convection has been modified to include the greater range of parameters and the effect of length to diameter ratio. Theoretical treatment of the free convection case has been studied to establish the validity of the basic equations governing the system. Data have been obtained and analyzed for the nucleate boiling regime. Additional data have been obtained for the dryout condition and on the formation of crusts on the capsule. Author (TAB)

N69-40067# Los Alamos Scientific Lab., N.Mex.
FLOW AND THERMAL CHARACTERISTICS OF HYDROGEN NEAR ITS CRITICAL POINT IN A HEATED CYLINDRICAL TUBE

Mahlon T. Wilson 13 Jun. 1969 160 p refs
(Contract W-7405-eng-36)
(LA-4172) Avail: CFSTI

The flow conditions and mechanism of hydrogen near its critical point in a heated cylindrical tube were investigated. The experimental apparatus consisted of a 1.376 in. ID 180 in. long, electrically heated vertical tube. Thermocouples and potential taps were located along the tube. An instrumented probe traversed in the tube near the exit end. The probe carried a pitot tube, a thermopile, and a hot wire anemometer sensor. Dynamic pressure, temperature, and hot wire anemometer bridge average and RMS voltages were measured as a function of test section radius. The data were represented by empirical equations. A special boiling number was found to be effective in correlating temperature differences for pressures greater than the critical pressure. Correlations were also obtained as a function of reduced pseudocritical temperatures. With pseudocritical temperatures slightly less than one, dynamic pressure, temperature, and average hot wire current were more nearly constant with respect to radius than at other temperatures. Author (NSA)

N69-40085# North Carolina State Univ., Raleigh. School of Engineering.
A STUDY OF THE OPERATING CHARACTERISTICS OF THE HEAT PIPE. PART 1: AN ANALYTICAL MODEL FOR THE PREDICTION OF OPERATING LIMITS OF HEAT PIPES. PART 2: CAPILLARITY IN POROUS MEDIA Final Report

J. K. Ferrell, J. H. Cosgrove, A. Carnesale, and E. M. Schoenborn 30 Apr. 1969 55 p refs
(Contract AT(40-1)-3411)
(ORO-3411-12-Pt-1-Pt-2) Avail: CFSTI

An analytical model is presented based on fundamental mass, heat, and momentum balances in the wick. It relates the maximum heat input to the fluid and wick characteristics and to the inclination of the pipe with respect to gravity. The model indicates that the critical parameters and operating characteristics are the capillary forces in the wick, pressure drop through the wick, and the operating temperature of the heat pipe. Maximum heat inputs in two experimental heat pipes were determined using packed beds of monel particles as wicking material and water as the working fluid. The agreement between the experimental results obtained and those predicted using the analytical model was excellent. Author (NSA)

N69-40104*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
SPACE THERMAL CONTROL BY FREEZING AND MELTING Interim Report
P. G. Grodzka. May 1969. 65 p. refs
(Contract NAS8-21123)
(NASA-CR-102268; LMSC/HREC-D148619; HREC/1123-2) Avail: CFSTI; CSCL 20M

A number of potential phase change materials are defined and evaluated. Of the 27 materials experimentally evaluated, 16, covering a range of melting points from 16°C to 102°C, are selected as being potential phase change materials. The most promising materials were lithium nitrate trihydrate with zinc-hydroxy nitrate catalyst, acetamine, methyl fumarate, and myristic acid. Also included are the results of a nucleation catalyst search. Of the two catalysts reported, the nature of one is fairly well established. The nature of the other is still unknown. Author

N69-40182 Aerojet-General Corp., Sacramento, Calif.
IGNITION PROBLEMS IN SOLID-PROPELLANT ROCKETS
B. E. Paul and R. L. Lovine. *In* AGARD. Advan. in Tactical Rocket Propulsion. Aug. 1968. p 195-248. refs. (See N69-40176 24-28)
Copyright. Avail: Issuing Activity

Methods of analysis of solid rocket motor ignition and igniter performance are given. Ignition and ignition internal ballistic performance are treated beginning with the combustion of the igniter pyrotechnic after the initiator has functioned. The ignition phenomenon is followed through the (a) igniter ballistic performance, (b) pre-ignition motor port volume pressurization and convective heat transfer (c) motor propellant grain ignition, and (d) subsequent motor ballistics to equilibrium motor operating pressure. Author

N69-40185 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SURVEY OF THE RELATIONSHIP BETWEEN THEORY AND EXPERIMENT FOR CONVECTIVE HEAT TRANSFER FROM ROCKET COMBUSTION GASES
D. R. Bartz. *In* AGARD. Advan. in Tactical Rocket Propulsion. Aug. 1968. p 291-381. refs. (See N69-40176 24-28)
(Contracts NASw-6; NAS7-100; DA-04-495-ORD-18)
Copyright. Avail: Issuing Activity; CSCL 20M

The problem of predicting the distribution of heat flux in a rocket engine is complicated by a flow field and thermodynamics so perturbed by as yet undescribable combustion effects that it continues to be necessary to utilize a simplified theoretical model against which to compare experimental results in order to gain insight. The most successful model applied to this problem is that of a compressible, turbulent, accelerating boundary layer flow with an arbitrary point of origin, and chemical reaction restricted to equilibrium recombination or diffusion-limited recombination on a catalytic wall. The paper summarized the analysis of this model and describes several closed-form equations that have also been developed and applied to the problem. Described are results of several experiments with hot air flow made for the purpose of checking the validity of the assumptions in the boundary layer analysis. Most significant, however, are presentations of sample distributions of local heat flux measured in rocket engines operating with a wide range of conditions, propellants, injectors and sizes. When compared with predictions, these data show the significant range of deviation in heat flux that results from the combustion effects. Author

N69-40187 United Technology Center, Sunnyvale, Calif. Physical Sciences Lab.
RESEARCH ON THE COMBUSTION MECHANISM OF HYBRID ROCKETS
G. A. Marxman and C. E. Woolridge. *In* AGARD. Advan. in Tactical Rocket Propulsion. Aug. 1968. p 421-477. refs. In ENGLISH; discussion partly in FRENCH. (See N69-40176 24-28)
(Contract NOw-64-0659-c)

Investigations of the turbulent boundary layer with heat transfer, mass transfer, and chemical reactions are reviewed, with emphasis on recent studies motivated by the hybrid combustion problem. Relatively high mass injection rates and rapidly changing composition and enthalpy boundary conditions along the boundary layer edge are inherent to the hybrid problem, and earlier treatments are somewhat inconsistent with this situation. To account for these aspects, a more recent analysis reviewed here differs from earlier ones in the way the mass transfer number B, or thermochemical driving force, is related to the thermodynamic parameters of the propellants and flow and in the treatment of the heat transfer blocking effect caused by wall mass injection. It is shown that the present boundary layer analysis is applicable up to $B \approx 100$, while the maximum thermochemical driving force available from any possible combination of propellants is less than 40. This analysis is used to predict the regression rate performance of several typical propellant combinations with good accuracy. Author

N69-40231# Rome Univ. (Italy). Centro Ricerche Aerospaziali.
A UNIVERSAL METHOD FOR DETERMINING THE EFFECTS OF AN EXPLOSION [UN METODO GENERALE PER LA DETERMINAZIONE DEGLI EFFETTI DI UNA ESPLOSIONE]
Michele Sirinian. Jul. 1968. 26 p. refs. In ITALIAN; ENGLISH summary
(Rept-16) Avail: CFSTI

A universal method to determine the effects of an explosion is presented. This method is based on the principle of similarity which yields, for each geometrical configuration, a unique law to determine a certain effect regardless of the physical characteristics of the mean which fills the ambient and the energy released by the explosive reaction. Only one geometrical configuration is analyzed; the surface burst. For this configuration the curves to determine the overpressure, the arrival time and the duration of explosive wave are given. As an example the curves are used to calculate the effects of a burst of given energy release on the surface of three different planets. Author

N69-40273 Michigan Univ., Ann Arbor.
A BOILER TUBE PROBLEM: ELASTIC-PLASTIC BEHAVIOR OF A THICK-WALLED CYLINDER CAUSED BY SINUSOIDAL INSIDE SURFACE TEMPERATURE, INTERNAL HEAT GENERATION AND EXTERNAL HEAT FLUX
Raymond William Kauppila (Ph.D. Thesis). 1968. 145 p.
Avail: Univ. Microfilms: HC $6.80/Microfilms $3.00. Order No. 69-2333

The mathematical solution is presented for the thermoelastic-plastic behavior of an unrestrained, thick-walled cylinder. It is shown that the first yielding occurs on the inside surface of the cylinder. The yielding consists of two zones. The first yield zone, defined by ρ_2/a, is governed by the single yield condition, $\sigma_z - \sigma_t - 2K_s = 0$. The second yield zone, defined by

ρ_1/a, follows closely behind the first yield zone and is governed by the two yield conditions $\sigma_Z - \sigma_r - 2K_s = 0$ and $\sigma_\theta - \sigma_r - 2K_s = 0$. The equations that define the mechanical behavior of the cylinder are presented in integral form and numerical aids are presented in graphical form for a selected range of variables. The results from two experimental runs are reported and indicate good agreement with the mathematical results for first cycle yielding. Experimental results further show that yielding caused by a periodic temperature is not limited to the first cycle. Dissert. Abstr.

N69-40297# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL INVESTIGATION OF SPECTRAL PROPERTIES OF AIR AT HIGH TEMPERATURES
A. A. Konkov et al 20 Jun. 1969 20 p refs Transl. into ENGLISH from Russian
(AD-692144; FTD-MT-24-32-69) Avail: CFSTI CSCL 7/4

Experimental investigations were made of spectral absorption indexes of air at temperatures above 10,000 degrees K with the aim of determining more accurately the role of the thermal radiation at very high Mach numbers. The shock tube used could produce shock-wave velocities from 2 to 10 km/sec. A block diagram of the experimental setup is shown and its operation is described in some detail. The methods and results of earlier Soviet and foreign investigations are evaluated with the view to identifying the causes of discrepancies between the theories and experimental data which exist, at shock wave velocities above Mach 24. Author (TAB)

N69-40354 Princeton Univ., N.J.
EFFECTS OF MONOMOLECULAR FILMS ON EVAPORATIVE HEAT AND MASS TRANSFER OF WATER
Uri Navon (Ph.D. Thesis) 1968 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-2552

The effects of insoluble monomolecular surface films on the evaporation of water and on the heat transfer from the water to the surface were investigated. The role of natural convection in the evaporative heat transfer mechanism was determined by making use of the unique reversal in the temperature dependence of water density at 4°C. With clean water surfaces at bulk temperatures higher than about 4°C a substantial increase was observed in the Nusselt number, which expresses the ratio of total heat transfer through the water to that which could be accounted for by conduction alone. This increase indicates that gravity-driven convection, induced by the evaporative cooling of the surface layer, indeed enhanced both the heat transfer to the surface and the evaporation rate. Dissert. Abstr.

N69-40356*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A METHOD OF INTEGRAL RELATIONS SOLUTION FOR RADIATING, NONADIABATIC, INVISCID FLOW OVER A BLUNT BODY
John T. Suttles Washington Oct. 1969 60 p refs
(NASA-TN-D-5480) Avail: CFSTI CSCL 20D

An approximate computational scheme was developed in which a method of integral relations is used to calculate the radiating, nonadiabatic, inviscid flow field for a blunt body reentering the earth's atmosphere. The method was applied for a one-strip approximation with an equilibrium-air gas model. A radiation model was used which takes into account the frequency dependence of the radiation, self-absorption by the gas, and atomic-line radiation as well as the important continuum radiation processes. Results calculated by the method are presented for a sphere at conditions representative of an earth reentry of a manned vehicle from an interplanetary mission. These results show general features for a radiating, nonadiabatic flow which are in agreement with other reported results. It is also shown that the radiative heat fluxes on the surface of a sphere, nondimensionalized with the stagnation-point value, are relatively insensitive to both nonadiabatic effects and body size. In addition, adiabatic results are presented which show that the large overpredictions of stagnation-point tangential-velocity gradient, which have been found in solutions by other methods of integral relations, have been avoided. Author

N69-40374# Rocket Propulsion Establishment, Westcott (England).
STUDIES OF COMBUSTION IN WELL STIRRED REACTORS: AN ANNOTATED BIBLIOGRAPHY
P. T. Hinde Mar. 1969 13 p refs
(AD-691706; TM-498) Avail: CFSTI CSCL 21/2

The 41 items contained in the bibliography provide a fairly comprehensive listing of basic combustion studies using well-stirred reactors. A particular attempt has been made to include all papers reporting rate data. Items are listed in chronological order. Author (TAB)

N69-40389# Army Foreign Science and Technology Center, Washington, D.C.
THE NATURE OF DETONATION OF CERTAIN EXPLOSIVES AND THE EFFECT OF PRESSURE ON IT
K. K. Andreev et al 29 Apr. 1969 10 p refs Transl. into ENGLISH from Nauchn. Dokl. Vysshei Shkoly, Khim. Khim. Tekhnol. (USSR), no. 2, 1958 p 229 - 232
(AD-691319; FSTC-HT-23-1072-68) Avail: CFSTI CSCL 19/4

The report is an analysis of the causes and effects of detonation of explosives during combustion. A sharp increase in pressure is cited as the principal effect necessary to cause combustion to become detonation. Tests were performed consisting of heating of nitroglycerin until detonation occurred. Heating rate influenced the detonation in a complex manner, with moderate heating rates producing the most explosive detonation. One major mechanism for the formation of detonation is the explosion of suspended droplets of detonable material in the combustion products of the explosive. Author (TAB)

N69-40390*# Atlantic Research Corp., Alexandria, Va.
QUENCHING AND EXTINGUISHMENT OF BURNING SOLIDS IN OXYGEN-ENRICHED ATMOSPHERES Final Report
Robert L. Durfee and Jack M. Spurlock 22 Sep. 1969 53 p refs
(Contract NAS9-8470)
(NASA-CR-101970) Avail: CFSTI CSCL 20M

An experimental program covering two areas in the general field of fire hazards in spacecraft atmospheres was conducted. These are: (1) Quenching distances for flaming samples of three polymers were determined, as were also quenching parameters for thin polymer films in contact with a heat sink backing. Maximum quenching distances (quenching by a brass foil) observed at oxygen pressures just great enough to allow ignition were about 1/2 inch. Thin films less than about 1/64-inch thick would not propagate flame when protected by a heat sink backing. (2) A fire extinguisher was designed and tested which effectively utilized inert gas as an extinguishing agent. Flaming samples of plastic rods and foams were all extinguished within about five seconds under the test conditions used. Nitrogen, argon, and carbon dioxide produced similar results as extinguishing agents for foam samples with the carbon dioxide producing the shortest extinguishment time of 2.3 sec. Author

N69-40393# North Carolina State Univ., Raleigh. School of Engineering.
STUDY OF THE OPERATING CHARACTERISTICS OF THE HEAT PIPE. PART 3: VAPORIZATION HEAT TRANSFER

FROM FLOODED WICK COVERED SURFACES Final Report
J. K. Ferrell and J. Alleavitch 30 Apr. 1969 182 p refs
(Contract AT(40-1)-3411)
(ORO-3411-12-Pt-3) Avail: CFSTI

The mechanism of vaporization heat transfer on a system with a fluid-wick combination that had well-defined geometric parameters and physical properties has been examined. The experimental apparatus consisted of a horizontal, stainless steel surface with a bed of monel beads of various sizes and depths in contact with it. The beds were covered with 2- through 4-inch depths of distilled water. The experimental data indicated very strongly that, in contrast to ordinary pool boiling, the heat transfer coefficient was very nearly constant for all heat fluxes below the critical value and that the latter is reached when the capillary forces are no longer sufficient to maintain liquid in contact with the heated surface. Analytical models were derived for both the heat transfer coefficient and the critical heat flux and are shown to be in excellent agreement with the experimental results obtained. Author (NSA)

N69-40437*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PENETRATION MODEL EXPLANATION FOR TURBULENT FORCED-CONVECTION HEAT TRANSFER OBSERVED IN NEAR-CRITICAL FLUIDS
Robert W. Graham Washington Oct. 1969 31 p refs
(NASA-TN-D-5522) Avail: CFSTI CSCL 20M

The traditional steady-state model of turbulent convection in a thermal boundary layer has been modified to include a nonsteady penetration component of heat transfer. The penetration mechanism is assumed to result from appreciable changes in the specific volume of local agglomerates of fluid near the wall under heating conditions. In some respects the penetration mechanism is similar to boiling. The overall model has been applied to forced convection of several fluids near their critical thermodynamic state. Some success has been achieved in using the model to account for the differences between the experimental data and conventional turbulent flow heat-transfer correlations for variable property fluids. Author

N69-40454*# Purdue Univ., Lafayette, Ind.
AN INVESTIGATION OF NONEQUILIBRIUM EFFECTS ON COMBUSTION IN SUPERSONIC STREAMS
Charles Alexander Bryce (Ph.D. Thesis) Jan. 1969 131 p refs
(Grants NGR-15-005-013; NsG-592)
(NASA-CR-106356) Avail: CFSTI CSCL 21B

The effects were investigated theoretically and experimentally using nonequilibrium hydrogen and vitiated air. The objective was to determine the difference in combustion performance between vitiated air and heated air under identical operating conditions. The vitiated air was produced in a gas generator burning nitrogen tetroxide and hydrazine with a nitrogen diluent. The product contained approximately 19 wt/% of water, replacing an equal volume of nitorgen in real air, 25% oxygen, and 55% nitrogen. The stagnation temperature (2200° K) and the stagnation pressure (1000 psia) of the experimental conditions simulated a flight Mach number of $M_\infty = 6.5$ at an altitude of approximately 80,000 ft. The results of this study show that the nonequilibrium free-radical content from a vitiated air source will cause early hydrogen ignition in a supersonic combustion mode. An analysis of heated air expanded from a high-temperature source to test section conditions also indicates that there is sufficient free-radical content in the incoming flow to cause early ignition. Therefore, neither vitiated air nor heated air will simulate free-flight supersonic combustion performance in the regime where ignition delay times are rate-controlling. Author

N69-40455*# Purdue Univ., Lafayette, Ind. Thermophysical Properties Research Center.
A COMPREHENSIVE PROGRAM FOR THE COMPILATION AND ANALYSIS OF THERMAL RADIATIVE PROPERTIES DATA
D. P. De Witt, M. C. Muinzer, and R. S. Hernicz Washington NASA Sep. 1969 126 p refs
(Contract NSR-15-005-037)
(NASA-CR-1431) Avail: CFSTI CSCL 11B

The program's objectives are to identify, collect, extract and analyze data on the thermal radiative properties for general dissemination. Effort is being concentrated on the technological materials of special interest to aerospace requirements under environmental conditions likely to occur in space application. Data are presented in tabular and graphical forms with accompanying tables giving specifications for the test specimens. For each material four prime properties are identified — emittance, reflectance, absorptance and transmittance — and further grouped according to geometric conditions (hemispherical, normal and angular) and wavelength conditions (spectral, total, solar, and integrated). When sufficient evidence exists, the data was analyzed and figures of "recommended" values for specific surface and/or environmental conditions are presented. The first part of the program is nearing completion (metallic elements and alloys) and the second and third parts are now well under way. Author

N69-40485# National Physical Lab., Teddington (England). Aerodynamics Div.
AN ANALYSIS OF THE ERRORS IN THE MEASUREMENT OF HEAT TRANSFER USING THE THIN-WALL TECHNIQUE
M. J. Larcombe May 1969 24 p refs
(NPL-AERO-1299; ARC-31215; HMT-221) Copyright. Avail: CFSTI

An analysis is made of the errors in the measurement of heat transfer introduced by the recording and subsequent calculation procedures. A computer simulation of these procedures has been made including the effects of noise superimposed on the signal from the temperature sensor and of the resolution and speed of the recording system. These errors are significant and are presented in graphical form to facilitate their estimation with a known recording system or to aid the selection of a recording system for a particular experiment. Author (ESRO)

N69-40529 Purdue Univ., Lafayette, Ind.
AN ANALYTICAL STUDY OF COMBINED FREE AND FORCED CONVECTION IN A HORIZONTAL TUBE
George Naim Faris (Ph.D. Thesis) 1968 157 p refs
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-2916

An analysis is made of combined free and forced convection heat transfer in laminar flow with constant physical properties inside a horizontal circular tube. The flow is assumed to be quasi-incompressible, i.e., variations in density due to temperature changes are neglected except in the modification of the body force in the momentum conservation equations. A constant wall heat flux along the tube and around the circumference is prescribed. It is further assumed that the inside tube wall temperature is constant along the circumference but varies linearly downstream. The governing partial differential equations are properly nondimensionalized. This procedure, among other things, involved the evaluation of a characteristic reference velocity for the mixed convection phenomena and suitable for non-dimensionalizing the tangential and radial velocity components. Dissert. Abstr.

N69-40780*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONVECTIVE HEAT-TRANSFER RATES ON LARGE-ANGLE CONICAL BODIES AT HYPERSONIC SPEEDS

David A. Stewart and Joseph G. Marvin. Washington. Nov. 1969. 16 p. refs.
(NASA-TN-D-5526) Avail: CFSTI. CSCL 20M

Heat-transfer rates were measured on large-angle conical bodies with large half-angles (δ) between 50° and 90°, at angles of attack from 0° to 30°. The results at 0° angle of attack were predicted with Lees' similarity theory, using calculated flow properties at the boundary-layer edge. The calculated flow properties were obtained from Newtonian theory for the 50° cone and from a one- or two-strip solution using the method of integral relations for the other cones. At 0° angle of attack, an increase in cone angle resulted in a decrease in the heating rate over much of the body. However, high heating rates occurred at the shoulder of both the δ = 80° and δ = 90° shapes because of local pressure gradients. On the windward side of the cones, the heating rate increased with angle of attack. Author

N69-40789*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONVECTIVE HEAT-TRANSFER COEFFICIENTS FROM A SOLUTION OF THE CONDUCTION EQUATION FOR A WALL SEPARATING TWO FLUIDS, ONE HAVING AN OSCILLATING TEMPERATURE
Ronald G. Huff. Washington. Oct. 1969. 84 p. refs.
(NASA-TN-D-5520) Avail: CFSTI. CSCL 20M

The temperature response of a wall which separates two fluids, one having a sinusoidally oscillating temperature, has been analytically determined. The solutions show that the convective heat-transfer coefficients on both sides of the wall can be determined experimentally if a single wall temperature along with the hot fluid and coolant temperatures are known as functions of time. From traces of these temperatures, the frequency of oscillation and either the amplitude ratio or the phase lag angle between the forced fluid and wall temperatures are measured. These are used in the solutions for the coefficients. The method is particularly applicable to rocket engines. Author

N69-40831# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
A SPECTROSCOPIC INVESTIGATION OF COMBUSTION-DRIVEN SPHERICAL IMPLOSION WAVES
D. E. Roberts. Sep. 1969. 49 p. refs.
(Contract AF 33(615)-5313)
(AD-691701; UTIAS-TN-140) Avail: CFSTI. CSCL 21/2

A spectroscopic study has been made of imploding shock waves in a hemispherical chamber filled with an H_2-O_2-He mixture at high initial pressures. In particular, temperature measurements at the origin of the chamber were made. Specific attention was paid to the use of the device as a driver for the Implosion-Driven Hypervelocity Launcher. Author (TAB)

N69-40845*# Bellcomm, Inc., Washington, D.C.
STATISTICAL ANALYSIS OF PROJECT PYRO LIQUID PROPELLANT EXPLOSION DATA
P. Gunther and G. R. Andersen. 23 Jul. 1969. 211 p. refs.
(Contract NASw-417)
(NASA-CR-106408; TM-69-1033-3) Avail: CFSTI. CSCL 21B

In order to obtain approximate unconditional predictions of yield, allowing for self-ignition, a statistical regression analysis was employed which combined Project Pyro's small scale, primarily controlled ignition tests, with their large scale, primarily self-ignited tests. Even though the statistical populations represented by the two groups of tests are different, the procedure is considered to be appropriate for estimating the fall-off of yield with weight, in three of the four cases where the effect of ignition delay time could meaningfully be bypassed. Two cryogenic propellants were studied, LO_2/RP-1 and LO_2/LH_2, and two failure modes, confined by missile (CBM) and confined by ground surface (CBGS). Also analyzed were the small scale tests conducted to determine the effect of variables other than weight: tank and orifice geometry and ullage volume for CBM, and missile fall-back velocity for CBGS. The results of the analyses were mixed and generally reflected various limitations inherent in the data. Details are given on each of the four propellant-failure mode combinations. Author

N69-40945*# Atlantic Research Corp., Alexandria, Va.
STUDY OF FLAME INHIBITION AND VAPOR RELEASE BY MICROENCAPSULATED FIRE RETARDANT COMPOUNDS
B. K. Wesley Copeland, Guenther von Elbe, Edward T. Mc Hale, and Clayton Huggett. Sep. 1969. 71 p. refs.
(Contract NAS2-4988)
(NASA-CR-73380) Avail: CFSTI. CSCL 21B

This program was undertaken to support the development by the NASA Ames Research Center of fire resistant structural materials based on micro encapsulated fire extinguishing agents incorporated into polymeric matrices. Specific tasks included the evaluation of a series of agents for efficiency in flame extinguishment and a study of agent release from microcapsules. A series of organohalogen extinguishing agents were evaluated in the propane/air diffusion flame in an opposed jet burner. This method of evaluation was selected since it permitted introduction of the extinguishing agent from the fuel side of the diffusion flame, simulating the mode of action of the microcapsules in a fire situation. Significant differences in behavior were observed when the agent was introduced from the fuel side and from the air side of the burner. Of the agents studied, bromoform ($CHBr_3$) showed the best efficiency on a weight or volumetric basis. Its properties appear to be compatible with the microcapsule technique of application. On rapid heating, as when exposed to a fire, the microcapsules rupture due to internal pressure. Capsules will withstand internal pressures of the order of 100 to 200 psi. The sample of microencapsulated agent examined were quite heterogeneous with respect to particle size and wall thickness, resulting in considerable scatter in agent release properties. Author

N69-40959# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.
WUNDEE: A ONE-DIMENSIONAL RADIAL HEAT-TRANSFER COMPUTER PROGRAM FOR CONDUCTIVE AND RADIATIVE HEAT-TRANSFER SITUATIONS SUCH AS ARE MET IN REACTOR RIGS OF CYLINDRICAL FORM
Susan Llewellyn and R. F. Cox. Feb. 1969. 53 p. refs.
(AERE-M-2165) Avail: CFSTI

WUNDEE solves radial heat transfer problems arising on cylindrical models. The program is confined to a one-dimensional heat transfer situation and considers heat transmitted by conduction and radiation. The program is written for the IBM 360/165. NSA

N69-40992# Los Alamos Scientific Lab., N. Mex.
SCANDIUM SESQUIOXIDE ENTHALPHY AND HEAT CAPACITY AT HIGH TEMPERATURES
D. Sh. Tsagareishvili et al. 16 Jun. 1969. 4 p. Transl. into ENGLISH from Soobshch. Akad. Nauk. Gruz. (Tiflis), v. 49, 1968 p. 175-180. Sponsored by AEC.
(LA-4158-TR; TID-4500) Avail: CFSTI

Enthalpy and heat capacity of scandium sesquioxide was studied at 298 to 1600°K. The measurements of the high-temperature enthalpy were achieved by mixing in a massive calorimetric installation with an isothermal shell. The device for automatic dumping of the ampule from the calorimeter furnace is described. The equation obtained for the enthalpy (J/mole) as a function of absolute temperature at 298.15 to 1607.4°K was $H_T - H_{298.15} = 117.74T + 6.95 \times 10^{-3} T^2 + 26.78 \times 10^5 T^{-1} - 44702$ and for the true heat capacity of Sc_2O_3 (J/mole/deg) as a function of temperature it was $C_p = 117.74 + 13.90 \times 10^{-3} T - 26.78$

$\times 10^5 T^{-2}$. The results obtained deviate from published data about ± 5.7%. NSA

N69-40999# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPONTANEOUS COMBUSTION OF A HOMOGENEOUS GAS-AIR COMBUSTIBLE MIXTURE
D. B. Akhmedov et al 3 Jun. 1969 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk vz. SSR, Ser. Tekhn. Nauk (Tashkent), v. 11, no. 5, 1967 p 44–51
(AD-691667; FTD-HT-23-105-69) Avail: CFSTI CSCL 21/2

The authors investigate the combustion process in a combustion chamber, assuming that an exponential relationship exists between reaction rate and the temperature, that the reaction relative to the component which is in insufficient quantity has a first order, that the flow is uniform, and that the heat is removed only by heat transfer to the wall. The differential equation of combustion and heat balance is derived. The calculations are presented in detail. The investigations performed show that disregard of the combustion during the induction period and during the determination of the critical state may lead to inaccurate quantitative results. Author (TAB)

N69-41046# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
METHOD FOR SOLVING TRANSIENT HEAT TRANSFER PROBLEMS INCLUDING COMPUTER PROGRAMS AND AN ANALYSIS OF FORM SURFACE FACTORS
Donald C. Todd Aug. 1969 55 p refs
(Contract F40600-69-C-0001)
(AD-691426; AEDC-TR-69-121) Avail: CFSTI CSCL 20/13

A method for attacking a wide variety of commonly occurring heat-transfer problems is presented. The method stems from a mathematical model obtained by dividing a system into pieces. The differential equation of the temperature of each piece with respect to time is derived considering heat sources and heat transfer by conduction and radiation. The resulting system of first-order ordinary differential equations is put in a form convenient for programming a numerical solution by defining coefficients in terms of the data of the system. Form-surface factors are a generalization of form factors to include multiple reflections. The factor is defined and discussed. A formula is derived for the factor in terms of the form factors and the reflectivities. The form-surface factor relations for the conservation of energy and the reciprocity law are derived. Methods of calculation are discussed. A FORTRAN subroutine is presented that calculates the form-surface factors from the form factors and the reflectivities. Author (TAB)

N69-41062*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A HERMETIC INDUCTION MOTOR-DRIVEN PUMP FOR BRAYTON CYCLE HEAT REJECTION LOOP
Adolph C. Spagnolo, Richard R. Secunde, and James R. Vrancik 20 Oct. 1969 20 p refs
(NASA-TM-X-52698) Avail: CFSTI CSCL 20M

Two motor-driven pumps were tested in simulated Brayton-cycle heat rejection loops using dimethyl polysiloxane coolant fluid. The pumps ran equally well on both three-phase, 400-Hz, sine wave power and 400 Hz quasi-square wave input power from a static inverter. Pump pressure rise was at least 60 psi from zero flow to design flow of 3.7 gpm. Cavitation was heard at all flow rates when pump inlet pressure was reduced below 12 psia. Pump performance however was not affected until flow separation occurred at inlet pressures less than 1 psia. The pump continued to operate at a reduced pressure rise and flow rate, and at no time did it stop pumping fluid completely. Author

N69-41069# General Electric Co., Pleasanton, Calif. Nucleonics Lab.
THERMODYNAMIC DATA PROGRAM INVOLVING PLUTONIA AND URANIA AT HIGH TEMPERATURES Quarterly Report
E. A. Aitken and S. K. Evans Apr. 1969 9 p refs
(Contract AT(04-3)-189)
(GEAP-5777; QR-6) Avail: CFSTI

Results of work related to measurement of liquidus-solidus transformations, vaporization of urania, and oxygen redistribution in a temperature gradient are presented. Preliminary data are presented on UO_2–20% PuO_2 thermal gradient experiments carried out in the temperature range 1200° to 1600°C. Author (NSA)

N69-41083# Los Alamos Scientific Lab., N.Mex.
ENTHALPY AND SPECIFIC HEAT OF YTTRIUM SESQUIOXIDE AND CERIUM DIOXIDE AT ELEVATED TEMPERATURES
T. S. Yashvili et al 18 Jun. 1969 4 p refs Transl. into ENGLISH from Soobshch. Akad. Nauk. Gruz. (Tiflis), v. 46, 1967 p 409–413 Sponsored by AEC
(LA-4155-TR-TID-4500) Avail: CFSTI

A mixing method was used in a calorimeter for measuring the enthalpy of Y_2O_3 and CeO_2 at 298.15 to 1600°K. Empirical equations for the enthalpy and intrinsic heat capacity were obtained as functions of the temperature. NSA

N69-41183*# AiResearch Mfg. Co., Los Angeles, Calif.
COOLANT PASSAGE FIN HEAT TRANSFER AND PRESSURE DROP PERFORMANCE
F. M. Walters 7 Aug. 1969 35 p refs
(Contract NAS1-6666)
(NASA-CR-66844; AP-69-5348) Avail: CFSTI CSCL 20M

Procedures and results of tests of the hypersonic research engine cowl leading edge configurations designed for Mach number 8 flight, are described. Two 0.030 inch leading edge radius configurations, one designed for hydrogen coolant flow parallel and one designed for hydrogen coolant flow perpendicular to the leading edge were tested to determine heat transfer performance, thermal cycle performance and coolant flow distribution. Both hot gas and radiant heating tests were performed. Results indicate the thermal performance and 100 cycles 10 hour life requirements were met. Author

N69-41230# Mound Lab., Miamisburg, Ohio.
DERIVATION OF MODIFIED WEBER-SCHMIDT EQUATION FOR THERMAL TRANSPIRATION
G. T. McConville 1 Jun. 1969 18 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1627) Avail: CFSTI

A detailed derivation of a modified version of a Weber–Schmidt equation is given in which the dependence on momentum and thermal accomodation is explicitly given. The final form of the integral equation allows numerical solutions to be obtained from an iterative process. Author (NSA)

N69-41244*# United Aircraft Corp., East Hartford, Conn. Research Labs.
STUDY OF CATALYTIC REACTORS FOR HYDROGEN-OXYGEN IGNITION Final Progress Report, 28 Aug. 1968 – 28 May 1969
Arthur S. Kesten Jul. 1969 78 p refs
(Contract NASw-1795)
(NASA-CR-72567; UARL-H-910721) Avail: CFSTI CSCL 21B

An analytical study of a catalytic ignition system to promote hydrogen-oxygen combustion was performed in order to establish procedures capable of predicting the steady-state behavior of the

system. Included is the development of a computer program which is used to calculate the steady-state axial temperature and reactant concentration profiles in typical reaction chamber configurations. The computer program is based upon a mathematical model of the reactor system which considers both thermal and catalytic reaction of hydrogen and oxygen, along with simultaneous heat and mass transfer between the free-gas phase and the gas within the pores of the catalyst pellets. The computer program has been used to evaluate the effects of chamber pressure, feed temperature, stoichiometry, helium dilution, mass flow rate and catalyst bed configuration on the steady-state behavior of the reactor system. Author

N69-41355 Rensselaer Polytechnic Inst., Troy, N.Y.
THERMAL CONDUCTIVITY AND HEAT CAPACITY OF POLYETHYLENE BELOW 4 DEG K
You-chien Chiang (Ph.D. Thesis) 1968 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-2452

The thermal conductivities of partially crystalline polyethylenes were measured between 0.4 and 4.2°K. The densities of the samples were between 0.918 and 0.986 gm/cm^3 corresponding to volume crystallinity from 48.2 to 92.1%. The data at He^4 temperatures could be fit to Klemens' theory by assuming a frequency independent mean free path, l_i, in addition to the structure scattering mean free path. Teh value of l_i found was of an order of 1 μ which was about an order of magnitude smaller than the size of spherulites observed under an optical microscope. Below He^4 temperatures the thermal conductivity of the lower density samples became larger than that of the higher density samples. The heat capacities of four samples of density ranging from 0.934 to 0.986 gm/cm^3 were obtained by using the thermal diffusivity method between 2.2 and 4.2°K. A linear relation between heat capacity and crystallinity was found. By using the heat pulse method the heat capacity of a sample of density was obtained below 3.4°K. Dissert. Abstr.

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N69-40029*# Massachusetts Inst. of Tech., Cambridge. Dept. of Political Science.
INTERNATIONAL POLITICS AND INTERNATIONAL SCIENCE: A STUDY OF SCIENTISTS' ATTITUDES
Albert H. Teich (Ph.D. Thesis) Jun. 1969 427 p refs
(Grant NGL-22-009-019)
(NASA-CR-106330) Avail: CFSTI CSCL 05D

This dissertation reports on a study of the attitudes of nearly 400 scientists and engineers working in the international laboratoreis of Western Europe. Attitude surveys at CERN (the European Organization for Nuclear Research), ESTEC (the European Space Technology Centre), ISPRA (the largest EURATOM Joint Research Centre), as well as several smaller establishments, have been employed. Part One presents introductory and background material on the place of international laboratories defined within the general framework of science and international relations. In Part Two, data from the survey are employed in analyzing outstanding characteristics of the scientists who were drawn to the laboratories as well as their personal and professional reactions to the experience. Part Three, devoted to the scientists' political views, begins with a discussion of the place of politics in their lives. The remainder of Part Three follows up this general picture with an elaboration of the scientists' opinions of specific current issues. The final part consists of the implications of the survey responses from which the laboratories' scientific and political roles are assessed. Author

N69-40105# Naval Ordnance Lab., White Oak, Md.
ADVANCED TECHNIQUES IN TECHNICAL DOCUMENTATION
H. Lee Shimberg [1969] 14 p ref
(AD-690911) Avail: CFSTI CSCL 5/2

The four techniques discussed are: (1) A technical instruction book without text; (2) SIMM, a better way of arranging technical information; (3) Troubleshooting template, a device that enables the technician to locate a defective part more easily than by using conventional troubleshooting manuals; (4) A computer assisted troubleshooting method. Author (TAB)

N69-40126*# Pittsburgh Univ., Pa. Knowledge Availability Systems Center.
THE SPACE AND TECHNOLOGY TRANSFER PROGRAM Quarterly Report, 1 Jun. - 31 Aug. 1969
31 Aug. 1969 62 p
(Contract NSR-39-011-106)
(NASA-CR-106307; QR-2) Avail: CFSTI CSCL 05A

The report describes: (1) marketing of the RDC services with emphasis on net industrial income, the current status of the marketing activities, plans and objectives, tools of marketing, and the resulting clientele; (2) technical operations of the RDC with services provided and the quantitative units of service; and (3) analysis operations with strategy preparation for computer searches, manual searches, review of search output, impact studies, and aids to marketing. Author

N69-40130*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-57, VOLUME 3 FOR THE PERIOD 1 APRIL - 31 MAY 1969. SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
30 Jun. 1969 209 p refs
(Contract NAS7-100)
(NASA-CR-106347; JPL-SPS-37-57-Vol-3) Copyright. Avail: CFSTI CSCL 22A

Supporting technical research and development work summarized covers the various divisions in the NASA Space Program from future projects to extensive contributions from the propulsion division. Studies are also reported in systems and telecommunications, space and environmental sciences, engineering mechanics, and guidance and control. G.G.

N69-40286# National Physical Lab., Teddington (England). Ship Div.
DESIGN DATA FOR HIGH-SPEED DISPLACEMENT HULLS OF ROUND-BILGE FORM
W. J. Marwood and D. Bailey Feb. 1969 88 p refs
(NPL-SHIP-99) Copyright. Avail: CFSTI

Results of resistance tests on a systematic series of fast round-bilged displacement type model hulls are presented. The models comprising the series have been derived by producing geometric variations of a basic form. The models were run in smooth water and for each experiment model speed, resistance and running time were measured. ESRO

N69-40302*# George Washington Univ., Washington, D.C.
ASSESSMENT INFORMATION SYSTEMS
Clarence H. Danhof *In its* Technol. Assessment Jul. 1967 p 1-20 refs Sponsored by NASA (See N69-40301 24-05)
Avail: CFSTI CSCL 05B

The assessment of new technology is stressed as an integral part of the process of accomplishing technological change. The

central concern of the assessment process in contemporary society is with the adverse effects of new technology and the relationships that follow between users and originators. These effects include human death, personal injury, and collective injury. The great need for a formal information or communication structure, particularly in areas viewed over a long period of time, is emphasized; major difficulties lie in the basence of a platform and an audience before whom the assessments of experts can be given adequate and authoritative consideration in light of long-range public policy. This is particularly true in situations where no immediate threat to life is involved, but public action must be secured in order to implement the recommendations of expert evaluators. It is suggested that a possible solution may lie in a periodic, authoritative, public review of the nation's progress toward achieving scientific and technical goals. A.C.R.

N69-40303*# Library of Congress, Washington, D.C. Science Policy Research Div.
TECHNOLOGY ASSESSMENT AND THE CONGRESS
Richard A. Carpenter *In* George Washington Univ. Technol. Assessment Jul. 1969 p 33-46 refs Sponsored by NASA
(See N69-40301 24-05)
Avail: CFSTI CSCL 05B

The role of the legislative branch as the major forum for technology assessment is discussed, based on the thesis that Congress is the most important user of such evaluative information and that an effective contact must be created between government and the scientific community in order to optimize the use of knowledge for social benefit. Emphasis is placed on the method by which Congressional decision makers can best obtain the required information for assessments, since experience to date indicates that conventional legislative reference services are inadequate in the fields of science and technology. The conclusion of recent deliberations was that a bridge between Congress and the scientific community for this purpose was preferable to an "in house" group of practicing scientists and engineers to act as advisers on specific subject matter. The Science Policy Research Division of the Legislative Reference Service appears to be the best instrument for realizing such a contact. Its services assure competent and timely assessments and the transfer of results into a form applicable to legislative decisions. The fact that applied science completely permeates society, however, suggests the need for additional assessment capabilities for other governmental, as well as commercial and academic, institutions. A.C.R.

N69-40384*# National Aeronautics and Space Administration, Washington, D.C.
FOREIGN LICENSING: U.S. GOVERNMENT AGENCIES
Frederick J. Lees 1969 55 p Presented at Intern. Pat. Licensing Conf., 9 Oct. 1969
(NASA-TM-X-61909) Avail: CFSTI CSCL 05A

The objectives, management, and implementation of governmental patent programs are summarized with emphasis on the foreign patent program of NASA. The fundamental objectives are (1) exclusive protection, (2) freedom of action to the maximum practical extent, (3) licensing for income, and (4) licensing with know-how. Pamphlets on signicant NASA inventions and domestic patents for NASA inventions are also included. J.A.M.

N69-40410# RAND Corp., Santa Monica, Calif.
ON DIFFERENT METHODS FOR ALLOCATING RESOURCES
Martin Shubik Jul. 1969 12 p refs
(AD-691864; P-4161) Avail: CFSTI CSCL 5/3

The paper discusses the various means of allocating resources within an economy. The following eight processes appear to be the major means for the allocation of resources: the economic market with a price system, voting procedures, bidding, bargaining, allocation by higher authority, fiat or dictatorship; allocation by force, fraud and deceit; allocation by custom, including gifts and inheritance; and allocation by chance. TAB

N69-40498# RAND Corp., Santa Monica, Calif.
PROJECT MODELLING: A TECHNIQUE FOR ESTIMATING TIME COST PERFORMANCE TRADE OFFS IN SYSTEM DEVELOPMENT PROJECTS
E. V. W. Zschau Jul. 1969 105 p refs
(Contract F44620-67-C-0015)
(AD-691810; RM-5304-PR) Avail: CFSTI CSCL 5/1

A methodology is outlined for estimating time-cost-performance tradeoffs to help in planning weapon system development projects. Techniques are given for developing a mathematical programming model of the project, solving it, and performing marginal analyses on it to derive the desired tradeoff possibilities. Models are based on the major design equations of the system being developed, the time precedence relationships among the major project activities, and estimates from responsible project personnel of the time and resources needed to do various technical jobs. Information derived from the models should be useful not only in the initial planning stages of a project, but during the actual development work when effective replanning is necessary. Consideration is also given to certain important methodological problems that must be solved to make the project modeling approach operational. TAB

N69-40801# Royal Greenwich Observatory, Herstmonceux (England).
GREENWICH TIME REPORT, APRIL-JUNE 1968
R. v. d. R. Woolley [1969] 14 p
Avail: CFSTI

This bulletin lists the results of the photographic zenith tube time and latitude observations made at Herstmonceux during the period April to June 1968 along with the reception times of radio time signals and standard frequency emissions. ESRO

N69-40802# European Space Research and Technology Center, Noordwijk (Netherlands).
THE MANAGEMENT OF THE HEOS-1 PROJECT [REFLEXIONS SUR LA GESTION DU PROJET HEOS-1]
J. A. Vandenkerckhove *In* ESRO ESRO/ELDO Bull., Suppl.: HEOS-1 Aug. 1969 p 6-13 In FRENCH (See N69-40801 24-31)
Avail: CFSTI

Experience gained during four years as the head of the HEOS project team are discussed. It is stressed that the responsibilities of the project leader lie not so much with technical matters but are mainly of a management nature. ESRO

N69-40879# Technische Hochschule Munchen (West Germany).
THE RUNOFF COEFFICIENT AND ITS DEPENDENCE ON THE DURATION OF A RAIN [DER ABFLUSSBEIWERT UND SEINE ABHAENGIGKEIT VON DER REGENDAUER]
Rolf Pecher (Ph.D. Thesis) 1969 194 p refs In GERMAN
Avail: CFSTI

Theoretical evaluations and measured data are used to form a mathematical model for calculating watershed runoff coefficients in correlation with rainfall duration for the design of water drainage systems. The model considers the various effects of evaporation, infiltration, flow peaks, water loss, and surface depressions. Best results were obtained when: (1) the runoff area was subdivided into porous and solid areas; (2) the values of peak runoffs and overall runoff were correlated with the amount of rain; (3) the peak runoff and overall runoff values were functions of the Reinhold exponential series with a rain probability of n; (4) the median runoff value was also correlated to rain volume and rain duration; and (5) the peak runoff value was larger than the overall runoff value after a certain time. Transl. by G.G.

N69-41006*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PROGRAM AND PROJECT MANAGEMENT: A DEMAND BIBLIOGRAPHY
9 May 1969 57 p refs
(NASA-TM-X-61920; GP-698) Avail: CFSTI CSCL 05B

This bibliography lists references published chiefly during the 1960s. Most of the works relate to activities in aerospace technology. The references are arranged according to the following subject headings: (1) budgeting and cost analysis; (2) critical path method; (3) general management and organization; (4) PERT and combination of PERT/critical path method; (5) reliability and quality assurance; (6) research and development; (7) scheduling; (8) selection; and (9) unique programs and projects. K.W.

N69-41085# Library of Congress, Washington, D.C. Aerospace Technology Div.
FOREIGN SCIENCE BULLETIN, VOLUME 5, NUMBER 9
Sep. 1969 95 p refs
Avail: Issuing Activity

This paper presents reviews of the following: (1) Soviet automatic interplanetary station technology and management, with special emphasis devoted to the Venera-type spacecraft; (2)design criteria for improving the performance of diffraction radiation generators, based on the orotron configuration, in the millimeter and submillimeter bands; and (3) Soviet research on thermo- and photochromic spiropyrans, practical capabilities and limitations of systems of the benzospiropyran-indoline series in liquid solutions on polymer films, and synthesis of the new materials. Activities of the Soveit Oceanographic Commission during 1968 are surveyed, and brief notes are given for research on photocathodes for ultraviolet detectors, rawin and laser sounding of the atmosphere, and computers in hydrological forecasting. R.B.

N69-41115# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS
Sep. 1969 54 p refs
Avail: CFSTI

CONTENTS:

1. RADIATION SOURCES FOR STELLAR TELESCOPE CALIBRATION FROM 700 ANGSTROMS TO 7000 ANGSTROMS W. R. Hunter (E. O. Hulburt Center for Space Res.) p 1-9 refs (See N69-41116 24-14)

2. SURFACE CHEMISTRY OF PLASTICS REINFORCED BY STRONG FIBERS W. A. Zisman p 10-29 refs (See N69-41117 24-18)

N69-41136*# National Aeronautics and Space Administration, Washington, D.C.
AN APPRAISAL OF THE HARBRIDGE HOUSE STUDY FROM THE RESEARCH AND DEVELOPMENT AGENCY VIEWPOINT
Leonard Rawicz 1969 21 p Presented at Briefing Conf. on Pat. Law, 26 Sep. 1969
(NASA-TM-X-61908) Avail: CFSTI CSCL 05A

Favorable and unfavorable reactions to a study on the effects of government patent policies are discussed. Effects on achieving the utilization of government financed inventions; obtaining the fullest participation of industry in government R&D programs; and competition in commercial markets were emphasized. The negative view questions the validity of the data base and the type of data collected; specific criticisms are listed. Although new concepts were not established, the study indicates the basic soundness of certain policies: (1) A single presumption of ownership to the inventions flowing from government R&D does not provide a satisfactory basis for either a government-wide patent policy or for the patent policy of a single agency or government program. (2) Operational flexibility in the allocation of rights to inventions resulting from government research and R&D is needed for the government agencies to accomplish their missions under different contracting situations. NASA patent policy is reviewed, and arguments in favor of specific patent legislation and administrative handling of these cases are offered. M.H.E.

N69-41140*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PRODUCTS LIABILITY: A DEMAND BIBLIOGRAPHY
2 Sep. 1969 17 p refs
(NASA-TM-X-61919; GP-756) Avail: CFSTI CSCL 05B

This bibliography lists mainly articles which have been published in periodicals. The articles are concerned with engineering, production, and legal aspects of product liability and treat the subject from the manufacturer's point of view. K.W.

N69-41157# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRANSLATIONS OF THE THIRD ALL-UNION CONFERENCE ON INFORMATION RETRIEVAL SYSTEMS AND THE AUTOMATED PROCESSING OF SCIENTIFIC AND TECHNICAL INFORMATION, SELECTED PARTS
9 Jun. 1969 18 p refs Transl. into ENGLISH from Russian Conf.
(AD-692625; FTD-MT-24-131-69) Avail: CFSTI CSCL 5/2

The report comprises an article entitled One Method of Organization of a Dictionary and Cycles of Programs for the Ural-4 Computer Servicing this Dictionary. TAB

N69-41190# Congress. House. Committee on Science and Astronautics.
CENTRALIZATION OF FEDERAL SCIENCE ACTIVITIES
Washington GPO 1969 509 p refs Hearings before Comm. on Sci. and Astronaut., 91st Congr., 1st Sess., No. 10, 10 Jul., 22-24 Jul., 28-31 Jul., 7 Oct., and 9 Oct. 1969
Avail: Subcomm. on Sci., Res., and Develop.

As the justification of spending increasing amounts of tax revenues to strengthen American science is under critical examination, hearings were held on the feasibility of centralizing Federal science activities. It is pointed out that, aside from funding, organizational patterns affect the planning and coordination of science and engineering programs, and the allocation of resources within any given budget is determined by the administrative structure used. Three parts to the executive science organization problem are seen: (1) The mission agencies have a continued need for research results which they must be free to pursue. (2) The patronage of university research and advanced training must be assured at an appropriate level. (3) The White House science apparatus must be sustained and strengthened to serve the President, the Congress, and the executive departments. The testimony presented examines a number of aspects, and the advantages and disadvantages of several reorganization plans are assessed. M.G.J.

N69-41191# Congress. House. Committee on Appropriations.
NASA AUTHORIZATION OF APPROPRIATIONS FISCAL YEAR 1970 Conference Report
George P. Miller Washington GPO 1969 13 p Presented by Comm. on Conf. with H.R. 11271 at the 91st Congr., 1st Sess., 6 Nov. 1969
(Rept-91-609) Avail: US Capitol, House Document Room

The recommendations made by the committee of conference on the disagreeing votes of the two Houses are presented. Also included is the statement of the managers on the part of the House in explanation of the effect of the action agreed upon by the conferees. M.G.J.

N69-41278# Congress. House. Committee on Science and Astronautics.
A STUDY OF TECHNOLOGY ASSESSMENT
Chauncey Starr (Natl. Acad. of Eng.) et al Washington GPO Jul. 1969 217 p refs Prepared by the Natl. Acad. of Eng., Comm. on Public Eng. Policy for the House Comm. on Sci. and Astronaut.
Avail: SOD: $1.25

Studies were undertaken to characterize the sociotechnical research that discloses the benefits and risks to society emanating from alternative courses in the development of scientific and technological opportunities. The methodology used is described, the experience gained in using task forces to conduct such studies is analyzed, and the interaction of the methodology with the organizational mode used is examined. The following are among the principal findings: (1) Technology assessments on a broad range of subjects are feasible and can be expected to be useful to the decision-making processes of the Congress when prepared by properly constituted, independent, ad hoc task forces with adequate staff support and time. (2) Technology assessments should be produced in an environment free from political influence or predetermined bias. (3) Members of the task force should be chosen for their expertise but not as representatives of affected parties or special interests. (4) Task force members will necessarily come from public and private organizations that have knowledge about the subject. M.G.J.

N69-41291# European Space Vehicle Launcher Development Organization, Paris (France).
EUROPEAN SPACE ORGANIZATIONS: ELDO [LES ORGANISATIONS SPATIALES EUROPEENNES: CECLES/ELDO]
M. M. Bourely [1969] 28 p In FRENCH Presented at the Colloq. of the Fac. de Droit et des Sci. Econ. and the CEDECE on Legal Frameworks of Intern. Cooperation in the Sci. Field and the European Probl., Aix-en-Provence, France, 1 – 2 Dec. 1967
Avail: CFSTI

Background history is given on the development of the cooperative European group, CECLES/ELDO, and its organizational attributes. Events at the Conference of Strasbourg in 1961 directed at the construction of rocket vehicle launchers, and the multigovernmental nature of the prepatory group are cited. Successful launchings of Europa 1 and Europa 2 are credited to the institutional framework of CECLES/ELDO, particularly the judicial statutes which controlled intergovernmental contracts and personnel. Operating principles of the organization are listed; the unique contribution is in the distinction between the organization in which all seven member states function, and the specific outlet of the organization in programs relevant only to rocket launching development. Specific technology reclamation and exchange-of-knowledge problems are explained. M.H.E.

N69-41313# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON EASTERN EUROPE SCIENTIFIC AFFAIRS, NO. 56
18 Jun. 1969 26 p refs Transl. into ENGLISH from Eastern European publications
(JPRS-48256) Avail: CFSTI

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1 FIRST JOINT SOVIET BLOC SPACE EXPERIMENTS UNDER WAY K. B. Serafimov p 1 – 3 (See N69-41314 24-29)
2 PROBLEMS OF NAVAL HEALTH SERVICE DESCRIBED Gh. Nottara et al p 4 – 8
3 RESEARCH IN POWER ENGINEERING DESCRIBED Remus Radulet p 9 – 15
4 STABILIZED ARC AS EXCITATION SOURCE FOR SPECTROCHEMICAL ANALYSIS M. Marinkovic et al p 16 – 19 refs (See N69-41315 24-06)
5 INCIDENCE OF INFECTIOUS DISEASES REPORTED p 20 – 21

N69-41378# European Space Vehicle Launcher Development Organization, Paris (France).
COORDINATION OF SPACE PROGRAMS: THE EUROPEAN SPACE CONFERENCE [LA COORDINATION EN MATIERE SPATIALE: LA CONFERENCE SPATIALE EUROPEENNE]
M. M. Bourely [1969] 26 p refs In FRENCH Presented at the Colloq. of the Fac. de Droit et des Sci. Econ. and the CEDECE on Legal Frameworks of Intern. Cooperation in the Sci. Field and the European Problem, Nice, 6 – 7 Dec. 1968
Avail: CFSTI

The establishment of a uniquely European space organization (CSE) is described which was charged with the research and development of satellite technology and applications, more powerful launch vehicles, synchronous satellites and telecommunication, organizational solidarity, and cost constraint to be borne by all the member nations. Purposeful coordination of activities is emphasized to avoid conflict with three current European space organizations: CERS/ESRO, CECLES/ELDO, and CETS. Conferences are cited describing the role of CSE as it was changed to the effective coordination of the three existing organizations. The present structure, the functions, and the institutional framework requiring many member nations cooperating in ventures of facility allocation, technology, applications, and program development are discussed. Transl. by M.H.E.

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EUROPEAN

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